

MLS-0003-00(161) and MLS-0003-00(246)
Widening of SR 403/I-85 from
North of SR 109 to North of SR 34
P.I. Nos. 0003161 and 0003246
Coweta, Meriwether and Troup Counties, Georgia

## Value Engineering Study Report

Concept Development Stage April 2005

Design Consultants R.K. Shah & Associates, Inc., Daniel Consultants, Inc., and Sastry and Associates, Inc.

Value Engineering Consultants

Lewis & Zimmerman Associates, Inc.



### Lewis & Zimmerman Associates, Inc.

Taking the Chance out of Change

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April 27, 2005

Ms. Lisa L. Myers
Design Review Engineer Manager
State of Georgia Department of Transportation
General Office
No. 2 Capitol Square, Room 266
Atlanta, Georgia 30334-1002

re: Project Numbers MSL-0003-00(161) and (246)

Inside Widening of SR 403/I-85 from North of CR 109 to North of SR 34

Troup, Meriwether and Coweta Counties, Georgia

Value Engineering Study Report

Dear Ms. Myers:

Lewis & Zimmerman Associates, Inc. is pleased to submit four hard copies and one electronic copy of the referenced report.

The alternatives and design suggestions addressed during this VE effort deal with the primary focus areas and identified opportunities that would improve the value of the project in terms of: increased capacity, reduced congestion and travel time, improved safety and level of service, and precluding pavement failure.

We thank you, the State of Georgia Department of Transportation participants, the Federal Highway Administration, and the R. K. Shah & Associates, Inc. design team for the efforts to assist the VE team in generating creative, alternative solutions for this project. We look forward to working with you on future assignments and are available to answer any questions you may have as you review these alternatives and determine implementation.

Sincerely,

LEWIS & ZIMMERMAN ASSOCIATES, INC.

Luis M. Venegas, PE, CVS, LEED<sup>TM</sup>

Vice President

Attachment

### **TABLE OF CONTENTS**

EXECUTIVE SUMMARY	
Introduction  Description	2
Project Description	2
Concerns and Objectives	2 3
Highlights of the Study Summary of Potential Cost Savings	5 5
Summary of Folential Cost Savings	3
STUDY RESULTS	
Introduction	7
Results of the Study	7
Evaluation of Alternatives	7
Value Engineering Alternatives	9
PROJECT DESCRIPTION	
Project Description	83
VALUE ANALYSIS & CONCLUSIONS	
General	88
Preparation Effort	88
Value Engineering Workshop Effort	88
Post-Workshop Effort	93
Value Engineering Study Agenda	94
Value Engineering Workshop Participants	96
Economic Data	99
Cost Estimate Summary and Cost Histograms	100
Function Analysis	114
Creative Idea Listing and Judgment of Ideas	116

### **EXECUTIVE SUMMARY**

### INTRODUCTION

This value engineering (VE) study report summarizes the events and results of the VE study conducted by Lewis & Zimmerman Associates, Inc. (LZA) for the State of Georgia Department of Transportation (GDOT), Atlanta, Georgia. The subject of the study was the widening of State Route (SR) 403/U.S. Interstate Highway (I) - 85 from north of SR 109 to north of SR 34 known as Project MSL-0003-00(161), P. I. No. 0003161 in Meriwether and Coweta Counties, Georgia and Project MSL-0003-00(246), P. I. No. 0003246 in Troup and Meriwether Counties, Georgia. The project is being designed by the R. K. Shah & Associates team from Atlanta, Georgia.

### PROJECT DESCRIPTION

These projects widen 28.59 miles of SR 403/I-85 from north of Forest Road (Mile Post (M.P.) No. 18.312) in Troup County to north of SR 34 (M.P. No. 46.914) in Coweta County. When completed, the projects will provide three 12-ft. travel lanes and 14-ft. inside and outside shoulders in each direction divided with a variable width depressed grass median. The project includes the inside widening, reconstruction and jacking of bridges in the corridor to improve vertical clearances to a minimum of 17 ft. The projects improve the existing pavement cross slope to 2.00% and will provide one closed circuit television remote controlled camera per direction at each interchange.

The current probable cost of construction for MLS-0003(161) is noted to be \$119,894,126 and for MLS-0003-00(246) \$104,473,995. The projects' costs include inflation at 5.00% per annum for two years (10.25%) and Engineering and Construction at 10.00%. The combined total cost is \$224,436,811.

### **CONCERNS AND OBJECTIVES**

Both projects are scheduled for completion in the relatively near future with MSL-0003-00(161) leading MSL-0003-00(246) by about year. The projects are very straightforward calling for the widening by two lanes of SR 403/I-85 for almost 29 miles in each direction with their associated bridge widenings and jackings.

Although the proposed designs are straightforward, the VE team noted several areas of concern: (1) not taking more advantage of the existing roadway assets for inside widening to minimize operational impacts; (2) consideration of cable guardrails in lieu of concrete barriers; (3) choosing an alternative edge-of-pavement configuration to minimize cracking and breakage; (4) either withholding the work on Big Poplar Road bridge due to another project that is to convert this area into a full scale interchange or conversely accepting the interchange work as part of these projects now; and (5) taking the risk of trying a different stone-matrix asphalt mix for the interlayer of the road section.

In order to accomplish the project's goals in an expeditious and cost-effective manner, and to assist in ameliorating the concerns noted, GDOT engaged this VE study. The objective of the effort was to identify opportunities that would improve the value of the project in terms of: minimizing operational disruptions, improving constructibility, improving safety, and potentially reducing capital cost.

### HIGHLIGHTS OF THE STUDY

As stated above, the project is a relatively straightforward widening of the SR 403/I-85 corridor in Troup, Meriwether, and Coweta Counties of Georgia. Numerous ideas were developed including using inside widening, changing the composition and thickness of the road cross section, and reducing the vertical clearances associated with the existing bridges. Listed below are some of the more important ideas developed in the study.

Alternatives 1, 7A, 7B, and 7C all change the design by widening all the new construction to the inside rather than a combination of both outside and inside of the existing travel lanes. Alternative 1 retains the 64-ft. median typical section as-designed. The 88-ft. typical section would be modified to widen to the inside by having the existing outside lane become the 12-ft. paved shoulder and the existing inside lanes becomes the 12-ft. outside lanes. Then widen to the inside to provide two additional 12-ft. lanes, a 12-ft. full depth paved shoulder and a 16-ft. paved median with concrete median barrier. This solution adds about \$2,000,000 but would shorten the construction time – savings which could not be determined due to insufficient information on phasing costs.

Alternative 7A would shift the improvements to the inside in a similar manner as Alternative 1 with concrete median barriers and a piped drainage system in the 88-ft. median section of the projects. Savings could be over \$5,000,000. In a like manner, Alternative 7B would shift the improvements to the inside but uses a cable guardrail instead of the concrete barriers while retaining the piped drainage system in the 88-ft. median section for a cost savings nearing \$10,000,000. The most radical of the proposals is 7C that provides improvements to the inside, uses cable guardrails and opts for a ditch drainage system within the 88-ft. median section with cost savings close to \$12,000,000.

The current projects call for a pavement section comprised of: 11-inches of continuous reinforced concrete (CRC); 3-inches of asphaltic concrete Superpave (19 mm aggregate size; spread rate of 330 pounds/square yards); asphaltic concrete leveling course; and a 12-inch graded aggregate base course. It may be possible to use a thinner pavement section by addressing the depth of the CRC. This pavement section was explored resulting in two potential areas worthy of further discussion: (1) Alternatives 4 and 5 which would change the interlayer beneath the CRC layer and above the base course, and (2) Alternatives 20, 22, and 23 which would reduce the overall thickness of the CRC.

For the interlayer options Alternative 4 suggests exploring the use of 4.75 millimeter (mm) stone/aggregate for the mix of the inner layer with any loss of thickness made up with asphalt. Since this mix has a higher asphalt content and smaller aggregate size, it produces a less permeable barrier than the 19 mm Superpave mix to keep water away from the base course. The 4.75 mm mix is also a more flexible mix which should dissipate stresses and reduce cracking of the CRC. This alternative notes savings close to \$6,000,000. Alternative 5 would use a 9.50 mm aggregate in lieu of the 4.75 noted above producing a matrix with the same improvements over the Superpave; however, savings increase to nearly \$11,600,000.

Looking at the CRC, it may be possible to use a thinner pavement section by addressing the depth of the CRC. Three possible solutions are: (1) using higher strength concrete with higher strength steel; reinforcement (2) using higher strength concrete with the current strength steel reinforcement; and (3) using current concrete strength with higher strength steel reinforcement. The potential of a thinner pavement section warrants exploration due to the potential savings associated with the cost of concrete at \$49.50/square yard (SY). As noted in Alternatives 20, 22, and 23, a reduction of even 0.5-inches for almost 60 miles of roadway could amount to over \$5,600,000.

The minimum vertical clearance dictated to the design team by GDOT is 17 ft. This is 1 ft. over the mandated Federal Highway Administration (FHWA) vertical clearance of 16.0 ft. and 0.5 ft. over GDOT's own standard of 16.5 ft. Three alternatives were pursued to address the impact of this requirement. Alternative 3 sought to lower the highway in lieu jacking eleven bridges and still achieve the desired 17-ft. vertical clearance, this produced a savings of about \$300,000. Alternative 6 would meet the GDOT standard of 16.5-ft. vertical clearance and save nearly \$1,100,000. Third, Alternative 8 would meet FHWA's standard of 16.0 ft. for vertical clearance could save close to \$1,950,000.

During the study, it was revealed that a project to convert the Big Poplar Road bridge area into a full-scale interchange was already under design with expected construction to commence about two years after completion of the current projects. This being the case, three options associated the Big Poplar Road bridge exist for these projects: (1) do nothing to the bridge under the current projects and save about \$280,000 as noted on Alternative 12; (2) construct the new bridge to accommodate the proposed interchange thereby increasing the work effort of the current projects but reducing the proposed follow-on work in the immediate future as stated in Alternative 13 (cost calculations were not possible due to lack of information about the interchange) or and (3) construct the interchange as part of the current projects and minimize the known future disruption immediately following a major widening effort as indicated in Alternative 14 (no costing data was available for this option either).

The *Summary of Potential Cost Savings* worksheet's which follow outline the alternatives and design suggestion developed by the VE team. Some of the alternatives are mutually exclusive or interrelated so that addition of all project cost savings does not equal total savings for the project. A full listing of all of the ideas considered by the VE team can be found on the *Creative Idea Listing* worksheets in the Section 4 of this report.



## **SUMMARY OF POTENTIAL COST SAVINGS**

PROJECT:

MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

Concept Development

### PRESENT WORTH OF COST SAVINGS

			THEOLITT	WORTH OF OOK	31 0/11/11/00	
ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
1	Widen the entire length of highway to the inside	\$115,248,073	\$117,172,172	(\$1,924,099)		(\$1,924,099)
3	Locally lower the road to eliminate bridge jackings	\$2,669,694	\$2,373,187	\$296,507		\$296,507
4	Use a 4.75 mm flexible mix for the interlayer beneath the continuous reinforced concrete pavement course	\$17,783,399	\$11,861,701	\$5,921,698		\$5,921,698
5	Use a 9.50 mm flexible mix for the interlayer beneath the continuous reinforced concrete pavement course	\$17,783,399	\$6,202,537	\$11,580,862		\$11,580,862
6	Meet the 16.5-ft. minimum vertical clearance	\$2,669,694	\$1,541,413	\$1,128,281		\$1,128,281
7A	Shift improvements to the inside and use concrete median barriers and a piped drainage system in the 88-ft. median	\$24,909,772	\$19,849,372	\$5,060,400		\$5,060,400
7B	Shift improvements to the inside and use cable guardrail and a piped drainage system in the 88-ft. median	\$24,909,772	\$14,885,741	\$10,024,031		\$10,024,031
7C	Shift improvements to the inside and use cable guardrail and a ditch drainage system in the 88-ft. median	\$24,304,050	\$12,304,766	\$11,999,284		\$11,999,284
8	Meet 16.0-ft. minimum vertical clearance	\$2,669,694	\$719,992	\$1,949,702		\$1,949,702
11	Eliminate the new game/right-of-way fence	\$4,485,229	\$448,523	\$4,036,706		\$4,036,706
12	Do no work on the Big Poplar Road bridge	\$281,385	\$0	\$281,385		\$281,385
13	Build Big Poplar Road bridge to future interchange standards as part of these projects		DES	SIGN SUGGES	ΓΙΟΝ	
14	Make the Big Poplar Road interchange a part of current projects		DES	SIGN SUGGES	TION	
15	Use pre-welded reinforcing mats in lieu of hand-tie mats for pavement reinforcement		DES	SIGN SUGGES	TION	
20, 22, 23	Use a thinner pavement section while maintaining operational requirements	\$124,028,031	\$118,390,389	\$5,637,642		\$5,637,642
21	Increase continuous reinforced concrete thickness and increase reinforcing bar spacing		DES	SIGN SUGGES	TION	
24	Use pavement "turndown" to reduce width of full depth shoulders	\$409,475	\$0	\$409,475		\$409,475
	<u> </u>	<u> </u>	<u> </u>		<u> </u>	

### STUDY RESULTS

### INTRODUCTION

The results are the major feature of a value engineering study since they represent the benefits that can be realized on the project by the owner, users and designer. The results will directly affect the project design and will require coordination among the designer, the user and the owner to determine the ultimate acceptance of each alternative.

### RESULTS OF THE STUDY

The VE team generated 28 ideas for change during the Function Analysis and Creative Ideas phases of the VE Job Plan. The evaluation of these ideas was based upon their potential for capital cost savings, probability of acceptance, availability of information to properly develop an idea, compliance with perceived quality, adherence to universally accepted standards and procedures, life cycle cost efficiency, safety, maintainability, constructibility and soundness of the idea.

Of the 28 ideas generated, 18 were sufficiently rated to warrant further investigation. Continued research and development of these ideas yielded 13 alternatives for change with an impact on project costs, and four design suggestion that will enhance the value of the project in terms of: durability, reduced labor effort/improved constructibility, and expansion of the work product. All of these alternatives and design suggestions are presented in detail following this narrative and on the *Summary of Potential Cost Savings* worksheets.

### **EVALUATION OF ALTERNATIVES**

It is important for the reviewer to consider each part of an individual alternative on its own merit. There may be a tendency to disregard an alternative because of concern about one portion of it. Separate consideration should be given to each of the areas within an alternative that are acceptable and those parts should be considered in the final design, even if the entire alternative is not implemented.

Cost is the primary basis of comparison for alternative designs. To ensure that costs are comparable within the alternatives proposed by the VE team, the designer's cost estimates, where possible, were used as the pricing basis.

Some of the alternatives are interrelated, so acceptance of one may preclude the acceptance of another. The reader should evaluate those alternatives carefully to select the ideas with the greatest beneficial impact to the project.



## **SUMMARY OF POTENTIAL COST SAVINGS**

PROJECT:

MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

Concept Development

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13	Build Big Poplar Road bridge to future interchange standards as part of these projects		DES	SIGN SUGGES	ΓΙΟΝ	
14	Make the Big Poplar Road interchange a part of current projects		DES	SIGN SUGGES	TION	
15	Use pre-welded reinforcing mats in lieu of hand-tie mats for pavement reinforcement		DES	SIGN SUGGES	TION	
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21	Increase continuous reinforced concrete thickness and increase reinforcing bar spacing		DES	SIGN SUGGES	TION	
24	Use pavement "turndown" to reduce width of full depth shoulders	\$409,475	\$0	\$409,475		\$409,475
	<u> </u>	<u> </u>	<u> </u>		<u> </u>	

## **VALUE ENGINEERING ALTERNATIVE**



PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

ALTERNATIVE NO.:

1

DESCRIPTION: WIDEN THE ENTIRE LENGTH OF HIGHWAY TO THE INSIDE SHEET NO.: 1 of 6

**ORIGINAL DESIGN: (Sketch Attached)** 

The original design calls for two typical sections one with an existing 64-ft. median and another with an existing 88-ft. median.

The 64-ft. median cross section calls for the construction of a full-depth, 12.0-ft. wide shoulder on the outside of the existing pavement, a 12.0-ft. lane on the inside, a 12.0-ft. wide full-depth shoulder pavement, and a 16-ft. wide paved median with a concrete median barrier in the center.

The 88-ft. median cross section calls for the construction of a full-depth, 12.0-ft. wide shoulder on the outside of the existing pavement, a 12.0-ft. wide lane on the inside, a 12.0-ft. wide full-depth shoulder pavement, and a 40-ft. wide grassed median.

**ALTERNATIVE**: (Sketch Attached)

The alternative design calls for the 64-ft. median typical section to remain as in the original design. The 88-ft. typical section is to be modified to widen to the inside. The existing outside lane will become the proposed 12-ft. wide paved shoulder and the existing inside lanes will become the proposed 12-ft. outside lanes. Then widen to the inside to provide two additional 12-ft. lanes, a 12-ft. wide full-depth paved shoulder, and a 16-ft. paved median with concrete median barrier.

### ADVANTAGES:

- Consistent typical section throughout corridor
- Easier to maintain traffic
- Saves time
- Improves work zone safety
- Improves constructibility

### **DISCUSSION:**

Widening on the inside of the existing 88-ft. median will create a typical section consistent with the 64-ft. median. Construction could be completed in two phases in lieu of four, making traffic easier to maintain.

Although the reduction in the number of phases would result in a savings, sufficient cost data was not available for the associated phasing plans. As such, the cost reduction due to the savings of construction/phasing time could not be calculated. However, it is believed the off-setting cost would result in an overall cost savings.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS		ESENT WORTH E-CYCLE COST
ORIGINAL DESIGN	\$ 115,248,073	3/4	\$	115,248,073
ALTERNATIVE	\$ 117,172,172	3/4	\$	117,172,172
SAVINGS	\$ (1,924,099)	3/4	\$	(1,924,099)

**DISADVANTAGES:** 

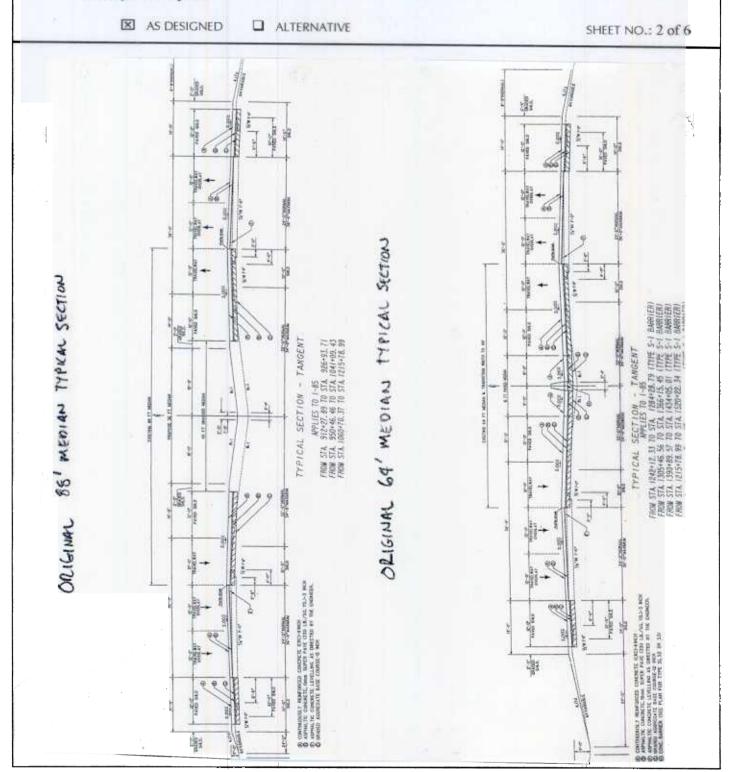
Increases initial cost

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

ALTERNATIVE NO.

Coweta, Meriwether, and Troup Counties

Concept Development



PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 **ALTERNATIVE NO.:** INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY Coweta, Meriwether, and Troup Counties Concept Development AS DESIGNED **ALTERNATIVE** SHEET NO .: 3 of 6 MEDIAN TAPICAL 9mm SIPERPAGE (330# 1ST)-3 INCH 囟 88 WELT BEINFALED CONCRETE (CRC)-11 INCH ALTERNATIVE 58 AUTODIARTIVE Pauen SHUD ONCOUNT



PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

ALTERNATIVE NO.:

SHEET NO .: 4 of 6

DESCRIPTION:

PRESENT MLS

COST IN CREASES - ADDITIONAL 13'-8" (16' MED - 2' 4" BARRIER) OF FUL DEPTH PAVEMENT IN

88 MEDIAN SECTION

- CONCRETE MEDIAN BARRION

COST SAVINGS - - TEMPORARY PAREMENT NOT REQUIRED FOR MAINTENANCE OF TRAFFIC

- EARTH WORK SAVINGS

- TRAFFIC CONTROL SAVINGS

UENGTH OF 88' MEDIAN SECTION - UNIT 161 - 35 500 LF UNIT 246 - 61 600 LF

CEC-11 INCH 7 UNIT 161 - (35 500 x 13'-8") | 9 = 54000 SY x \$49.5 | 51 = \$2,673,000
UNIT 246 - (61 600 x 13'-8") | 9 = 93600 SY x \$49.5 | 57 = \$4,633,200

19 mm Suparane = UNIT /61 - (35 Saux 13'-8") 9 - S4000 57 x 330 4/51 /200 = 8910 TON x 443 (TON

UNIT 246 - (61600 x 13'-8") 9 = 93600 SY x 3304/51/200 = 15444 TON x 43/PM

GARS - UNIT 161 - (35500 x 13'-8') x 1' 27 = 18000 CY x 2701/c7 = 3600 0 7011 x 13.40/m

= \$482400 UNIT 246 - (61600 x 131-8") x1 /27 = 31200 CT x 2 TON/CT = 62400 TONX \$ 13.40 FON = \$836,160

CONCRETE MEDIAN - UNIT 161 - 35500 LF + \$60.00/15 = \$2,130,000

BARRIEN UNIT 246-61600 LF + \$60.00/LF = \$3,696,000



PROJECT:

MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

DESCRIPTION:

ALTERNATIVE NO.:

SHEET NO .: 5 of 6

COST SAVINGS - DETOUR PANEMENT - NOT REQUIRED ON EACH SIDE IF WIDENING

TO INSIDE & NOTE: VERLEY TEMP PANEMENT SECTION DESIGN - MAY BE INSUFFICIENT
AS DESIGNED.

UNIT ILI + (35 500 LF x 12 FT x 2510ES) / 9 = 94 700 ST > Few ESTIMATE &

REQD - 191, 300 SY DEDUK MART e LS - \$4,782,500 = \$25 ST

94700 ST x \$25/87 = \$2,367,500

UNIT 246 7 (61600 UF x 12 FT x 25:005) /g = 164300 \$7 -> FROM ESTIMATE >

REQD - 208 900 SY DETOUR PYMT @ LS -\$5, 222, 500 = \$25 ST

164300 SY x \$25/SY = \$4,167,500

FARTHWOLK SAVINGS - GLADING IN THE MEDIAN WILL NOT BE REQUIRED TO

THE EXTENT SHOWN ON THE TYPICAL SELTION. THIS AREA WILL HOW

BE FULL DEPTH PAVEMENT. IN MEDIAN, THIS WILL MEAN APPROX

Z' OF EARTHWOLK REMOVED AT OLD EDGE OF PAVED SHLOS & O' OF EARTHWORK

CHANGE AT MEDIAN DITCH BOTTOM. THEREFORE, APPROX I'NOF TOTAL

EARTHWOLK REMOVED FROM GRASSED MEDIAN.

UNIT 161 - (35500 FT x 40'x 1') /27 = 52600 CY x \$3.00/CY = \$157800

UNIT 246 - (6160) FT x 40'x 1') /27 = 91300 CT x \$3.00/CY = \$273,900

TRAFFIC CINTREL SAVINGS - ELIMINATING ONE STAGE OF CONSTRUCTION WILL ELIMINATE THE NEED FOR PLACING TEMPORARY MEDIAN BARRIER, TP3 APPEARS TO BE SEPARATION TWICE, \* WOTE: PRECAST MEMAN BARRIER, TP3 APPEARS TO BE UNITIGIO-ORIGINAL DESIGN-REQUIRED IN STAGE 1,2 \$ 3-3x35500 x 2510E3 x \$36.00 = \$7,668,000 ALT. DESIGN-REQUIRED IN STAGE 1 \$2 - 2x 35500x 2510E3 x \$36.00 = \$5,112,000 UNIT 246-ORIGINAL DESIGN-REQUIRED IN STAGE 1,2\$3 - 3x61600 x 2510E3 x \$36.00 = \$13,305,600 UNIT 246-ORIGINAL DESIGN-REQUIRED IN STAGE 1,2\$3 - 3x61600 x 2510E3 x \$36.00 = \$6,870,400 ALD DESIGN-REQUIRED IN STAGE 1 \$2 - 2x61600 x 2510E3 x \$36.00 & \$6,870,400

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

Concept Development

ALTERNATIVE NO:

1

DESCRIPTION SHEET NO.: 6 of 6

DESCRIPTION			JILLI NO 0 01 0					
CONSTRUCTION ITEM	C	ORIGINAL I	ESTIMATE	PROPOSED ESTIMATE				
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL	
Project 161								
CRC 11"	SY	382,395	49.50	18,928,553	436,395	49.50	21,601,553	
19mm Superpave	TN	104,083	43.00	4,475,569	112,993	43.00	4,858,699	
GAB	TN	425,300	13.40	5,699,020	461,300	13.40	6,181,420	
Concrete Median Barrier	LF	36,310	60.00	2,178,600	71,810	60.00	4,308,600	
Detour Pavement	LS	1		4,782,500	1		2,415,000	
Unclassified Excavation	CY	215,000	3.00	645,000	162,400	3.00	487,200	
Precast Barrier, Method 3	LF	213,000	36.00	7,668,000	142,000	36.00	5,112,000	
Project 246								
CRC 11"	SY	417,600	49.50	20,671,200	511,200	49.50	25,304,400	
19mm Superpave	TN	107,800	43.00	4,635,400	123,244	43.00	5,299,492	
GAB	TN	440,780	13.40	5,906,452	503,180	13.40	6,742,612	
Concrete Median Barrier	LF	16,900	60.00	1,014,000	78,500	60.00	4,710,000	
Detour Pavement	LS	1		5,222,500	1		1,115,000	
Unclassified Excavation	CY	236,000	3.00	708,000	144,700	3.00	434,100	
Precast Barrier, Method 3	LF	369,600	36.00	13,305,600	246,400	36.00	8,870,400	
Sub-total				95,840,394			97,440,476	
Mark-up at 20.25%				19,407,680			19,731,696	
TOTAL				115,248,073			117,172,172	

## VALUE ENGINEERING ALTERNATIVE



PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

DESCRIPTION: LOCALLY LOWER THE ROAD TO ELIMINATE BRIDGE

**JACKINGS** 

ALTERNATIVE NO.:

3

SHEET NO.: 1 of 5

### **ORIGINAL DESIGN:**

Eleven bridges over U. S. Interstate Highway 85 (I-85) are to be jacked upward to achieve a minimal vertical clearance of 17.0 ft.

### ALTERNATIVE:

Lower the roadway at the eleven bridge locations in order to provide the desired 17.0-ft. vertical clearance without having to jack the bridges.

### **ADVANTAGES:**

- Saves initial cost
- Reduces complexity of construction coordination
- Simplifies design and construction
- Potentially reduces construction time
- Improves constructibility

### **DISADVANTAGES:**

Requires minimal redesign effort

### **DISCUSSION:**

This alternative answers the question: "What if we lower the road instead of raising the bridges in order to achieve the required vertical clearance of 17.0 ft.?" Interestingly enough, savings can be achieved with this solution; albeit not the normally anticipated solution.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	 RESENT WORTH FE-CYCLE COST
ORIGINAL DESIGN	\$ 2,669,694	3/4	\$ 2,669,694
ALTERNATIVE	\$ 2,373,187	3/4	\$ 2,373,187
SAVINGS	\$ 296,507	3/4	\$ 296,507



PROIECT:

MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP. COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

ALTERNATIVE NO.:

3

**DESCRIPTION:** 

SHEET NO .: 2 of 5

THIS ALTERNATIVE WOULD LOWER THE EXISTING ROADWAY IN LIEU OF JACKING UP THE BRIDGES TO MEET THE REQUIRED VERTICAL CLEARANCE — ASSUMED TO BE 17'-0". IT WAS PLANNED TO JACK BRIDGES TO ACHIEVE THIS CLEARANCE — ASSUMED AVERAGE JACKING HEIGHT = 12" (Some are less, Some are more)

### ALTERNATIVE

REMOVE EXISTING PAVEMENT AND BASE, UNDERCUT BY 12" AND REPLACE BASE AND PAVEMENT:

CURRENT PAVT SURFACE

PROPOSED
PAVT SURFACE

G" BASE

G"BASE

CURRENT
PROPOSED
PAVT SURFACE

G"CONC.

G"BASE

THE SURFACE ELEVATIONS BETWEEN THE PAVEMENT UNDER THE BRIDGE AND THE NEW, RESURFACED PAVEMENT, WILL BE SEPARATED VERTICALLY BY (12" LOWERING + 14" RESURFACING = 26").
ASSUME THIS DIFFERENCE WILL BE WORKED OUT BY 1/2 % SLOPE;

26"

POINT
UNDER
BRIDGE
DIST:

NEW PAVEMBUT (RESURFACED) ELEVATION

1/



MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 PROJECT:

INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

**ALTERNATIVE NO.:** 

3

**DESCRIPTION:** 

SHEET NO .: 3 of 5

TO MAKE THIS HAPPEN, WILL NEED TO EXCAVATE (CONSERVATIVELY) 2 × 433'= 866' OF EXISTING PAVEMENT AT EACH LOCATION, ASSUME PAVEMENT IS CURRENTLY 35' WIDE - FROM PAVEMENT EDGE TO PAVEMENT EDSE. QUANTITIES PER BRIDGE:

CONCRETE REMOVAL:

35 WIDE X 2 DIRECTIONS x 866 = 60, 620 SF

6,736 SY

BASE REMOVAL

35' WIDE x 2 DIRECTIONS x 6 1/2" x 866' = 30, 310 C.F.

UNCLASSIFIED EXCAVATION

DIRECTIONS X 1' UNDERCOT X 866'= 60,620 CF.

QUANTITIES ABOVE PER BRIDGE

 $\frac{1}{2} \times 433 \times 1 \times 35 \times 2 = 15,155 \div 27 =$ DICEGIONS

561 CY AT EACH



PROJECT:

MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN

TROUF COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

ALTERNATIVE NO .:

3

DESCRIPTION:

SHEET NO .: 4 of 15

OVERALL QUANTITIES:

BRIDGES OVER I-85-ASSUME 11

CONCRETE REMOVAL & DISPOSAL

LOCATIONS 6,736 **5Y** = 14. 096 C.Y.

BASE COURSE REMOVAL & DISPOSAL

1,123 CY LOCATIONS X 11

12 353

UNCLASSIFIED EXCAVATION & DISPOSAL

561 CY LOCATIONS X 11

Coy 6,171

ASSUMPTIONS

OF UNCLASSIFIED EXCAVATION & DISPOSAL USE TWICE UNCLASSIFIED EXCAVATION COST 2 x # 3 = = \$ #600 (#300/CY)

(2) DRAINAGE PER SITE - ALLOWANCE = \$10,000

UNIT COST FOR CONCRETE REMOVAL DISPOSAL \$2500 ( FROM GDOT ESTIMATING

(2) PAYEMENT COSTS WOULD REMIAN APPROXIMATELY THE SAME

# COST WORKSHEET

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

Concept Development

ALTERNATIVE NO:

3

DESCRIPTION SHEET NO.: 5 of 5

CONSTRUCTION ITEM		ORIGINAL ES	STIMATE	PROPOSED ESTIMATE			
CONSTRUCTION TIEW			DITIVIATE				
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
PROJECT 246							
Bridge Jacking:							
Bridge 10	LS	1	164,115	164,115			
Bridge 9	LS	1	164,115	164,115			
Bridge 7	LS	1	177,090	177,090			
Bridge 6	LS	1	172,440	172,440			
Bridge 8	LS	1	232,560	232,560			
Bridge 5	LS	1	208,245	208,245			
Bridge 4	LS	1	164,115	164,115			
Bridge 3	LS	1	172,440	172,440			
PROJECT 161							
Bridge Jacking:							
Bridge 5	LS	1	277,000	277,000			
Bridge 8	LS	1	234,000	234,000			
Bridge 9	LS	1	254,000	254,000			
Harland Branch	CV				6 171	6.00	27.026
Unclassified Excavation & Disposal	CY				6,171	6.00	37,026
Base Course Removal & Disposal	CY				12,353	6.00	74,118
Concrete Removal & Disposal Drainage Improvements Per Site	CY Site				74,096 11	25.00 909	1,852,400 10,000
							,
Sub-total				2,220,120			1,973,544
Mark-up at 20.25%			-	449,574			399,643
TOTAL				2,669,694			2,373,187

## VALUE ENGINEERING ALTERNATIVE



ALTERNATIVE NO.:

SHEET NO.: 1 of 5

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

DESCRIPTION: USE A 4.75 MILLIMETER FLEXIBLE MIX FOR THE

INTERLAYER BENEATH THE CONTINUOUS REINFORCED

CONCRETE PAVEMENT COURSE

ORIGINAL DESIGN: (Sketch Attached)

The original design calls for a 19 millimeter (mm) flexible mix interlayer beneath the continuous reinforced concrete (CRC) layer and above the base course of the existing pavement. The 19 mm interlayer is 3-in. thick with a spread rate of 330 lbs/sy.

**ALTERNATIVE**: (Sketch Attached)

Use a 4.75 mm flexible mix beneath the CRC and above the base course of the existing pavement. The 4.75 mm interlayer mix will be 2-in. thick with a spread rate of 220 lbs/sy.

### ADVANTAGES:

- Initial cost savings as less hot asphalt mix is needed
- Thinner pavement section
- Less permeable interlayer
- More flexible interlayer
- Less pavement height makes vertical clearance issues less difficult

### **DISADVANTAGES:**

- Not commonly used by GDOT
- GDOT's aversion to risk may preclude implementation
- Limited test data available

### **DISCUSSION:**

This alternative replaces the 19 mm Superpave interlayer with a 2-in. thick 4.75 mm interlayer. The 4.75 mm mix has a higher asphalt content and a smaller aggregate size. It will produce a less permeable barrier than the 19 mm Superpave mix to keep water away from the base course. The 4.75 mm mix is also a more flexible mix which should dissipate stresses and reduce cracking of the CRC.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	 RESENT WORTH FE-CYCLE COST
ORIGINAL DESIGN	\$ 17,783,399	3/4	\$ 17,783,399
ALTERNATIVE	\$ 11,861,701	3/4	\$ 11,861,701
SAVINGS	\$ 5,921,698	3/4	\$ 5,921,698

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 ALTERNATIVE NO .: INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY Coweta, Meriwether, and Troup Counties Concept Development SHEET NO .: 2 of 5 AS DESIGNED ■ ALTERNATIVE (6) - ASPHALTIC CONCRETE, 19mm SUPERPANE (330 LB/SY) ASPHALTIC CONCRETE, 19 MM SUPPREADE (330 45) 64' MEDIAN TYPICAL SECTION 88 MEDIAN TYPKAL SECTION SECTION - TANGENT TYPICAL ORIGINAL

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 ALTERNATIVE NO.: INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY Coweta, Meriwether, and Troup Counties Concept Development ☐ AS DESIGNED ALTERNATIVE SHEET NO .: 3 of 5 B. ASPHACTIC CONCRETE, 4.75 mm SUPERDAVE (220 UB/SY)-2 INCH D-ASPHALTIC CONCRETE, 4.75 MM SUPERPANE (220 40/54)-2 INCH 64' MEDIAN TYPICAL SECTION 88 MEDIAN TYPKAL SECTION TYPICAL SECTION - TANGENT ALTERNATIVE ACTERNATIVE



PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

ALTERNATIVE NO.:

4

**DESCRIPTION:** 

SHEET NO .: 4 of S

THE INTERVALER BY I' THICKNESS ACROSS THE FULL WIDTH OF PAVEMENT FOR THE ENTIRE LENGTH OF THE PROJECT.

AS DESIGNED - 3"-19 mm m 12 - 330 4/57

PROPOSED - 2"-4.75 mm mu - 2204/59

DIFFERENCE : ORIGINAL DESIGN x 2/3 = CHANGE IN ASPHALT

UNIT 161 & FROM CONCEPT COST ESTIMATE.

ITEM E. 6 - ASPHALTIC CONC. 19mm, 330 4/84-3" OVERLAY - 63100 TON C 43.00 From

ORIGINAL = \$ 2,713,300

Z" 4.75mm PROPOSED - 63100 x 2/3 = 42100 TON @ \$43.00/TON = \$1.810,300

1 TEM EIT - ASPHAUTIC CONC. 19 mm, 330 \$/54 - 3"NEW - 104083 C \$43.00/TON

ORIGNAL : \$ 4,975,569

2" 4.75 mg Proposen - 100083 x 2/3 = 69400 TON C \$43/TON = \$ 2,984, 200

UNIT 296 & FROM CONCEPT COST ESTIMATE:

TEM E.G - ASPHALTIC CONC 19mm, 3304/54-3" OVERLAY - 68990 TON @ \$43/TON

2" 4.75mm PROPOSEN - 68940 + 2/3 = 46000 TONC \$43 HON = \$1,978,000

ITEM F.7 - ASPHALTIC CONC. 19mm, 330 4/54 - 3" NEW : 107800 C \$43/ TON

ORIGINAL = \$ 4,635, 400

2" 4.75 mm Profoser - 107800 x 2/3 = 71900 TON C \$43/700 = \$3,091,700

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

Concept Development

ALTERNATIVE NO:

4

DESCRIPTION SHEET NO.: 5 of 5

DESCRIPTION				110 5 01 5			
CONSTRUCTION ITEM	C	RIGINAL E	STIMATE	PROPOSED ESTIMATE			
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Unit 161							
19mm Superpave - 3" Overlay	TN	63,100	43.00	2,713,300			
19mm Superpave - 3" New	TN	104,083	43.00	4,475,569			
4.75mm Superpave - 2" Overlay	TN				42,100	43.00	1,810,300
4.75mm Superpave - 2" New	TN				69,400	43.00	2,984,200
Unit 246							
19mm Superpave - 3" Overlay	TN	68,940	43.00	2,964,420			
19mm Superpave - 3" New	TN	107,800	43.00	4,635,400			
4.75mm Superpave - 2" Overlay	TN				46,000	43.00	1,978,000
4.75mm Superpave - 2" New	TN				71,900	43.00	3,091,700
Sub-total				14 700 600			0.864.200
			-	14,788,689			9,864,200
Mark-up at 20.25%			-	2,994,710		_	1,997,501
TOTAL				17,783,399			11,861,701

## **VALUE ENGINEERING ALTERNATIVE**



ALTERNATIVE NO.:

SHEET NO.: 1 of 5

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUPE COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

DESCRIPTION: USE A 9.50 MILLIMETER FLEXIBLE MIX FOR THE

INTERLAYER BENEATH THE CONTINUOUS REINFORCED

CONCRETE PAVEMENT COURSE

### **ORIGINAL DESIGN:**

The current design calls for the interlayer of the pavement to be 3 in. of 19 millimeter (mm) Superpave stone matrix asphalt (SMA) mix.

### ALTERNATIVE:

Use a 1-in. thick 9.50 mm SMA interlayer in lieu of the 19 mm Superpave mix.

### **ADVANTAGES:**

- Cost reduction because less hot asphalt mix (HMA) is required
- Lower permeability than 19 mm Superpave
- More flexibility than 19 mm Superpave
- Less pavement height makes vertical clearance issues less difficult

### **DISADVANTAGES:**

- Not commonly used by GDOT
- GDOT's aversion to risk may preclude implementation
- Limited test data available

### **DISCUSSION:**

The current project concept uses a 3-in. thick 19 mm Superpave interlayer between the existing concrete pavement and the new continuous reinforced concrete (CRC) overlay. The cost of this mix for both projects is \$17,783,399. The interlayer functions are to keep water out of the base and dissipate stresses from the underlying existing pavements.

This alternative replaces the as-designed interlayer with a 1-in. thick 9.50 mm SMA interlayer. The SMA mix has a higher asphalt content and smaller maximum aggregate size than the 19 mm Superpave. These characteristics will produce a less permeable barrier to better exclude water from the base, thus enhancing mix flexibility, which should better dissipate stresses from the underlying existing concrete pavement and reduce the potential for cracking in the new CRC.

As opposed to most SMA mixes that are used in surface applications, the 9.50 mm SMA used in this application could incorporate recycled asphalt pavement (RAP) material, so the cost for this mix should be closer to 9.50 mm Superpave than to 12.5 mm SMA. See calculation and cost sheets.

COST SUMMARY	INITIAL COST		PRESENT WORTH RECURRING COSTS	_	RESENT WORTH IFE-CYCLE COST
ORIGINAL DESIGN	\$	17,783,399	3/4	\$	17,783,399
ALTERNATIVE	\$	6,202,537	3/4	\$	6,202,537
SAVINGS	\$	11,580,862	3/4	\$	11,580,862

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 ALTERNATIVE NO.: INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY Coweta, Meriwether, and Troup Counties Concept Development SHEET NO .: 2 of 17 AS DESIGNED ■ ALTERNATIVE (B)- ASPHALTIC CONCRETE, 19 mm SUPERPRINT (330 LB/SY) - 3 INCH B) ASPRIACTIC CONCRETE, 19 MM SUPERFALTE (330 46/54)-3 INCH ORIGINAL 64 MEDIAN TIPICAL SCHOOL 58' MEDIAN TYPKA SECTION TYPICAL SECTION - TANGENT APPLIES TO 1-85 15-17-12 11 at NOLLOBS TEPTCAL ORIGINAL

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 ALTERNATIVE NO.: INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY Coweta, Meriwether, and Troup Counties Concept Development AS DESIGNED SHEET NO .: 30ff 64' MEDIAN TYPICAL SECTION REDIAN TYPKA SECTION 9.5 mm D-ASPHALTIC CANCRETE, SECTION B. ASPHIACTIC CONCRETE ATEN ATEN

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUPE COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

ALTERNATIVE NO.:

5

DESCRIPTION: SHEET NO.: 4 of 5

### Assumptions:

- 1. Weighted average cost of 9.5 mm Superpave is \$41.00/ton contains RAP. Weighted average cost of 12.5 mm SMA is \$70.00/ton is virgin and on surface. The 9.5 mm SMA is under an 11-in. CRC and should contain RAP to reduce cost. It should be closer to 9.5 mm Superpave than to 12.5 mm SMA in cost. **Assume \$45.00/ton.**
- 2. It is only necessary to recalculate the interlayer material costs. The leveling material costs should be the same as those shown in the current concepts.

### Calculations:

- 1. Check 3-in. layer quantities in concepts against calculations to produce a correction factor:
  - a. Concepts call for 343,923 tons of 3-in. 19 mm Superpave. Concepts total cost = \$14,788,689.
  - b. Calculation of 3-in. 19 mm Superpave quantity
    - i. (330lbs/SY)(20 YD)(28.602 miles)(1,760 YD/mile)(2 directions/2,000 lbs/ton) = 332,240 tons
  - c. Correction factor = 343,923/332,240 = 1.035
- 2. Calculation of 1-in. 9.5 mm SMA quantity and cost:
  - a. (110 lbs/SY)(20YD)(28.602 miles)(1,760 YD/mile)(2 directions/2,000 lbs/ton))(1.035 correction factor) = 114,623 tons
  - b. Cost = (\$45.00/ton)(114,623 tons) = \$5,158,038
- 3. Cost savings is \$9,630,650 before mark-ups.

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

Concept Development

ALTERNATIVE NO:

5

DESCRIPTION SHEET NO.: 5 of 5

DESCRIPTION		ı		SHEET NO.: 3 01 3				
CONSTRUCTION ITEM	С	RIGINAL E	ESTIMATE	PROPOSED ESTIMATE				
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL	
Project 161								
19mm Superpave - 3" Overlay	TN	63,100	43.00	2,713,300				
19mm Superpave - 3" New	TN	104,083	43.00	4,475,569				
Unit 246								
19mm Superpave - 3" Overlay	TN	68,940	43.00	2,964,420				
19mm Superpave - 3" New	TN	107,800	43.00	4,635,400				
Projects 161 and 246								
9.50mm SMA - 3" Overlay and New	TN				114,623	45.00	5,158,035	
Sub-total				14,788,689			5,158,035	
Mark-up at 20.25%				2,994,710			1,044,502	
TOTAL				17,783,399			6,202,537	

## **VALUE ENGINEERING ALTERNATIVE**



PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUPE COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

DESCRIPTION: MEET THE 16.5 FT. MINIMUM VERTICAL CLEARANCE ALTERNATIVE NO.:

SHEET NO.: 1 of 5

### ORIGINAL DESIGN:

The original design calls for jacking all overhead bridges to provide a 17.0-ft. vertical clearance over the continuous reinforced concrete (CRC) slab, which is being placed over the existing pavement.

### ALTERNATIVE:

Meet the 16.5 ft. minimum vertical clearance per Georgia Department of Transportation (GDOT) requirements. This will require dropping the existing roadway surface at bridge locations.

### ADVANTAGES:

- Eliminates bridge jacking
- Minimal disruption to overhead traffic
- Simplifies design and construction
- Improves constructibility

### DISADVANTAGES:

- Requires concrete removal and disposal
- Not able to use existing roadway as a base at these locations only

### **DISCUSSION:**

Grading a length under the overhead bridges to accept a 12-in. base course, 3-in. asphaltic concrete overlay, and an 11-in. CRC will require removal of the existing concrete and base for approximately 900-lf at each location to provide the 16.5-ft. vertical clearance required by GDOT. This effort will preclude jacking the existing overhead bridges. Keeping the minimum clearance at 16.5-ft. is acceptable since the concrete slab will not require an overlay.

COST SUMMARY	INITIAL COST		PRESENT WORTH RECURRING COSTS	 RESENT WORTH IFE-CYCLE COST
ORIGINAL DESIGN	\$	2,669,694	3/4	\$ 2,669,694
ALTERNATIVE	\$	1,541,413	3/4	\$ 1,541,413
SAVINGS	\$	1,128,281	3/4	\$ 1,128,281



PROIECT:

MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

ALTERNATIVE NO .:

6

INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

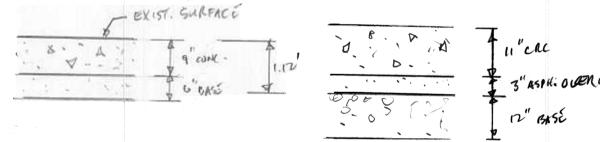
Coweta, Meriwether, and Troup Counties

Concept Development

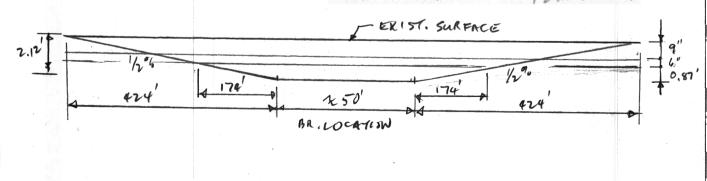
**DESCRIPTION:** 

SHEET NO .: 2 of 5

ADDITIONAL HEIGHT DUE TO INCREASE IN SUPERELEVATION: XE = (0.07 - 0.0104) (24') = 0.7304' ASPHALTIC OVERLAY =0.75' CRL SLAB CRC SLAB = 0.9167'
TOTAL = 0.7304' +0.75' + 0.9161' = 1.3971' MAXIMUM EXIST. MIN. VERT. CUETRANCE 150 NLY 17-3". THEREFORE, ALL GRIDGE SITES GRE AFFECTED. AVERAGED CLEARANG 15 16.78' IF 16.5' MIN. VERT. CLEAR IS ADDPTED, THE RUAD LAT CEAST AT THEBRIOGE SITE). HAS TO BE OROPPED BY, 1.40 -(K.78'-10.5')=1.12'



RODOWAY HAS TO BE DROPPED BY AN ADDITIONAL I PT. FUR THE BASE. THENTEONE ASSUME THAT 2.12 CAN FEATHER OUT AT 1/2% SLOPE.



PROIECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN

TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY Coweta, Meriwether, and Troup Counties

Concept Development

DESCRIPTION:

SHEET NO .: 3 of 5

**ALTERNATIVE NO.:** 

ASSUME EXISTING PAVEMENT IS 35' WIDE

CONCRETE REMOVAL

35'X2 DIRECTIONS X (50' +2x 424') x 0.75' = 1746.11 CYO.

BASE COURSE REMOVAL & DISPOSAL

35' X 2 DIRECTIONS X (50'+ 2x 424') X 0.50' = 1/64.07 CYD. 27 CFT/CYD

UNCLASSIFIED EXCAVATION & DISPUSAL

35' x 2 DIRECTIONS x (50'+ 174' x0.5 x2) = 580,74 C40. 27 CET/CYD

TOTAL QUANTITIES

ASSUME 11 BRIDGES

CONCRETE REMOVEL & DISPOSAL

11 LOCATIONS X 1744.11 CYOS = 19,207.21 CYO.

BASE COURSE REMOVER & DISPOSAL

11 LUCATIONS X 1164.07 CYDS

= 12,804.77 CYD.

UNCLASSIFIED EXCAVATION & DISPOSAL

= 6,388.14 CYD

11 LOCATIONS X 580.74 CHO

COST AS SUMPTIONS

(1) UNIT COST FOR CONC. REMOVAL & DISPOSAL (GODT EST.) = \$25,00 / CYD.

Q UNIT COST FOR BASE COURSE DEMOVAL & DISPOSAL = \$6.00 ( 40. CUSE DOUBLE THE UNCLASSIFIED EXCAVATION)

3 UNCLASSIFIED EXCAUATION

= \$3,00/040.



PROJECT:

MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

ALTERNATIVE NO .:

DESCRIPTION:

SHEET NO .: 4 of

ADDITIONAL BASE AGGLEGATE

35' XZ DIRECTIONS & (50'+2×42+') X 1.0' = 2:328.15 CYD.

27 CAT/CYO

TOTAL QUANTITY

11 LOCATIONS Y 2,326.15 CYOx 2 TONS/CYD = 51,219.26 TONS

WST KSSUMPTION

(4) GRADED KEELEGATE BASE 12"

= \$13.40 / TIN:

# COST WORKSHEET

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

Concept Development

**ALTERNATIVE NO:** 

6

DESCRIPTION SHEET NO.: 5 of 5

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
PROJECT 246							
Bridge Jacking:							
Bridge 10	LS	1	164,115	164,115			
Bridge 9	LS	1	164,115	164,115			
Bridge 7	LS	1	177,090	177,090			
Bridge 6	LS	1	172,440	172,440			
Bridge 8	LS	1	232,560	232,560			
Bridge 5	LS	1	208,245	208,245			
Bridge 4	LS	1	164,115	164,115			
Bridge 3	LS	1	172,440	172,440			
PROJECT 161							
Bridge Jacking:							
Bridge 5	LS	1	277,000	277,000			
Bridge 8	LS	1	234,000	234,000			
Bridge 9	LS	1	254,000	254,000			
Unclassified Excavation & Disposal	СҮ				6,388	6.00	38,328
Base Course Removal & Disposal	CY				12,805	6.00	76,830
Concrete Removal & Disposal	CY				19,208	25.00	480,200
Graded Aggregate 12"	TN				51,230	13.40	686,482
Sub-total				2,220,120			1,281,840
Mark-up at 20.25%				449,574			259,573
TOTAL				2,669,694			1,541,413

## **VALUE ENGINEERING ALTERNATIVE**



ALTERNATIVE NO.:

7 A

SHEET NO.: 1 of 9

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

**Concept Development** 

DESCRIPTION: SHIFT IMPROVEMENTS TO THE INSIDE AND USE

CONCRETE MEDIAN BARRIERS AND PIPED DRAINAGE

SYSTEM IN THE 88-FT. MEDIAN

ORIGINAL DESIGN: (Sketch Attached)

The original design calls for the addition of 60-ft. of continuous reinforced concrete (CRC) travel lanes in each direction and contains two typical sections; one with an existing 64-ft. median and another with an existing 88-ft. median.

The 64-ft. median cross section calls for the construction of a full-depth, 12.0-ft. wide shoulder on the outside of the existing pavement, a 12.0-ft. lane on the inside, a 12.0-ft. wide full-depth shoulder pavement, and a 16-ft. wide paved median with a concrete median barrier in the center.

The 88-ft. median cross section calls for the construction of a full-depth, 12.0-ft. wide shoulder on the outside of the existing pavement, a 12.0-ft. wide lane on the inside, a 12.0-ft. wide full-depth shoulder pavement, and a 40-ft. wide grassed median.

The widening of this corridor also requires the existing bridges to be reworked to accommodate not only the widening, but correction of the cross slopes as well. New mainline bridge construction will be carried out to the inside of the existing bridges while the existing bridges over the highway will be jacked to allow for a vertical clearance of 17.0 ft.

### **ALTERNATIVE**: (Sketch Attached)

In the 64-ft. median cross section, locate the ultimate section to the inside, reduce the inside shoulder from 19-ft. to 10-ft., and move the PGL 9 ft. to the inside. Shift the outside edge of pavement in 7 ft. of the 9 ft. saved on the inside and use 2 ft. of the 9 ft. saved to provide a 14-ft. wide outside lane striped at 12 ft. to control edge stresses. The existing 6% cross slope full depth shoulder is milled and inlayed to match the 1% cross slope of the existing pavement.

In the 88-ft. median cross section, locate the ultimate section to the inside, reduce the inside shoulder from 30 ft. to 18 ft., and move the PGL 12 ft. to the inside. Shift the outside edge of pavement into 10 ft. of the 12 ft. saved on the inside and use 2 ft. of the 12 ft. saved to provide a 14-ft. wide outside lane striped at 12 ft. to control edge stresses. Use a piped drainage system and Type S1 concrete barriers.

Bridges – There are two sets of existing bridges in Project 246 and all are in an 88-ft. median section. There are seven sets of existing bridges in Project 161—five within the 64-ft. median section and two within the 88-ft. median section. During Stage 1, construct the new bridges completely on the inside with a 22-ft. travel way width in both directions to the new PGL, stripe for two temporary 11-ft. lanes, and add a 3-ft. section outside of the PGL for placement of Method 4 temporary barrier. During Stage 2, shift traffic to the new bridges and new roadway, remove parapet walls from inside and outside (where required) of old bridges, jack and rotate the existing bridges, connect to new bridges with a pour strip, and reform the outside parapet wall (where required).

COST SUMMARY	I	NITIAL COST	PRESENT WORTH RECURRING COSTS		
ORIGINAL DESIGN	\$	24,909,772	3/4	\$	24,909,772
ALTERNATIVE	\$	19,849,372	3/4	\$	19,849,372
SAVINGS	\$	5,060,400	3/4	\$	5,060,400



ALTERNATIVE NO.:

7A

SHEET NO.: 2 of 9

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

DESCRIPTION: SHIFT IMPROVEMENTS TO THE INSIDE AND USE

CONCRETE MEDIAN BARRIERS AND PIPED DRAINAGE

SYSTEM IN THE 88-FT. MEDIAN

### DISADVANTAGES:

- Virtually all 30-year-old decks are retained, thus the life of old decks are only for another 20 or so years.
- Cost increase for 19 miles of concrete barrier
- Cost increase for 19 miles of piped, longitudinal drainage system
- Minimal mill and inlay of outside shoulder needed for cross slope correction in the 64-ft. median section

#### **ADVANTAGES:**

- More bridge width than needed for three lanes plus shoulders
- Additional width on outside would offset bridge widening when a future 4<sup>th</sup> lane is activated
- Bridge costs are minimized by retaining all old deck and all old beams
- No temporary pavement on outside shoulder is needed
- The outside shoulder in the 88-ft. median section is not disturbed
- Construction process is simpler
- Staging is easier

### DISCUSSION:

The current project concept adds median drainage and concrete barriers for only the 64-ft. wide median sections. The 64-ft. wide median comprises 33% of the entire length of both projects. The 88-ft. median section, which makes up the remaining 67% of the length of both projects, becomes a 36-ft. median with a drainage ditch. The positive barrier separating the directions of travel for the new 36-ft. median would benefit safety and prevent crossover accidents.

This alternative requires a drainage system and barrier on the 88-ft. median sections, thus increasing total barrier and drainage costs. Additionally, some milling and inlay of the outside shoulder along the 64-ft. wide median sections is required. However, the alternative eliminates the temporary pavement.

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 ALTERNATIVE NO.: INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN 7**A** TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY Coweta, Meriwether, and Troup Counties Concept Development **AS DESIGNED** ■ ALTERNATIVE SHEET NO .: 3 of 9 OPIGINAL 64" MEDIAN TYPICAL SECTIONS 861 MEDIAN TYPKAL SECTION SECTION EEE



**PROJECT** 

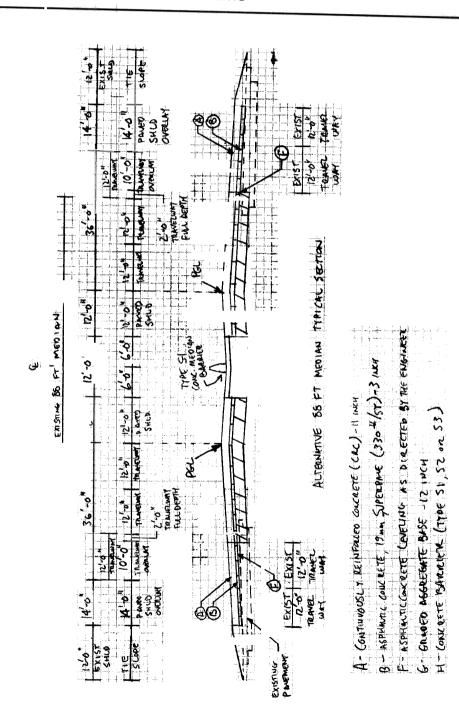
MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY Coweta, Meriwether, and Troup Counties Concept Development

7A

SHEET NO .: 4 of 9

☐ AS DESIGNED

☑ ALTERNATIVE



INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

Concept Development

ALTERNATIVE NO.:

7A

DESCRIPTION: SHEET NO.: 5 of 9

### **Assumptions:**

1. Full depth shoulder pavement exists on 6.50 feet of the shoulder per the drawings provided.

- 2. Longitudinal pipe median is 24-inch reinforced concrete (RCP) H1-10 priced at \$38.70/LF. Drop inlets are priced at \$25.00 each.
- 3. Outside shoulder is full depth at a 6% cross slope.

### **Calculations:**

1. Check concept report costs and quantities for both barrier and drainage:

Project	Barrier Quantity	Barrier Cost	Comment	Drainage Cost
246	16,900 LF	Incorrect at	Actual is	\$135,000
240	3.20 miles		\$1,014,000	\$133,000
161	36,310 LF	\$2,179,000	\$2,179,000	\$181,000
101	6.88 miles	\$2,179,000	\$2,179,000	\$101,000
Total	53,210 LF	\$2,460,000	\$3,193,000	\$316,000
Total	10.08 miles	\$2,400,000	φ3,193,000	φ310,000

2. Check Median width quantities for both projects

a. Length measurements taken from Concept Drawings

Project	64-foot Median	88-Foot Median	Transitions	
246	15,800 LF	62,400 LF	1,600 LF	
240	246 2.99 miles 11.82 miles	0.30 miles		
161	34,000 LF	34,800 LF	2,000 LF	
101	6.44 miles	6.59 miles	0.38 miles	
Total	49,800 LF	97,200 LF	3,600 LF	150,600 LF
Total	9.43 miles	18.41 miles	0.68 miles	28.52 miles
Percentage	33.06%	64.55%	2.38%	

- b. Concept Reports state project length is 28.605 miles close agreement. Thus the entire project length for barrier is 150,600 LF. *Using cable guardrail Type TL4 in the 88-foot median and corresponding transition is:* 97,200 LF + 3,600 LF = 100,800. The remaining 49,800 LF will use Type S1 concrete median barriers. [These calculations were not used for 7A]
- 3. Hot Asphalt Mix (HMA) density:
  - a. 1-inch HMA corresponds to a spread rate of 110#/SY.
  - b. 0.028 CY corresponds to a spread rate of 110# in a SY 1-inch thick.
  - c. 110#/0.028 CY = 3,960 #/CY.

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

ALTERNATIVE NO.:

7A

DESCRIPTION: SHEET NO.: 6 of 9

#### **Calculations continued:**

- 4. Determine the cost of installing a pipe drainage system to the entire length of both projects:
  - a. Determine drainage cost of 64-foot median section in Project 161 = (36,310 LF)(\$38.70/LF) = \$1,405,197.
  - b. Determine quantity of drop inlets assuming a 150-foot spacing = (36,310 LF)(150 LF) = 242.06;  $\therefore$  use 242.
  - c. Determine cost of drop inlets = (242 EA)(\$25.00/LF) = \$6,050.
  - d. Total cost of the drainage system in the 64-foot median is \$1,405,197 + \$6,050 = \$1,411,247 of 76% of the Project 161 drainage cost. This applies to 6.88 miles of Project 161. Extrapolating this to the entire 28.60 miles of the both projects is \$1,411,247/6.88 miles = \$205,123/mile; :: (\$205,123/miles)(28.60 miles) = \$5,866,520 the cost to pipe the entire length of both projects.
- 5. Reduce cost of Alternative 7 by the ditches not constructed in the 88-foot median if pipes are considered:
  - a. From Project 161 cost of non-median drainage is \$1,856,100 \$1,411,247 = \$444,853.
  - b.  $\therefore$  (\$444,853)/2.5 = \$177,942. \$177,942/6.50 miles = \$27,376/mile reduction. Therefore, reduction for the 18.4 miles of the 88-foot median not ditched is: (\$27,376/mile)(18.4 miles) = \$503,710.
- 6. Use Alternative 7 the drainage cost of Projects 161 and 246 is \$1,856,100 (for Project 161) + \$1,346,000 (for Project 246) + \$5,866,520 (total cost new drainage system) \$503,710 (reduction for the 88-foot median) = \$8,564,910. This amounts to an overall drainage increase of \$5,362,810.
- 7. Cost of temporary pavement added according to the current concept:
  - a. 8-inch graded aggregate base (GAB) at \$10.50/SY:
    - $\therefore$  (\$10.50/SY)(4 YD)(28.6 miles)(1,760 YD/mile)(2 directions) = \$4,228,224.
  - b. 5-inch, 25 millimeter (mm) HMA at \$44.00/ton, 550#/SY; this equals (550#/2,000#/ton)(\$44.00/ton) = \$12.10/SY)
    - $\therefore$  (\$12.10/SY)(4 YD)(28.6 miles)(1,760 YD/mile)(2 directions) = \$4,872,525.
  - c. 2-inch, 19 millimeter (mm) HMA at \$41.00/ton, 220#/SY; this equals (220#/2,000#/ton)(\$41.00/ton) = \$4.51/SY)
    - $\therefore$  (\$4.51/SY)(4 YD)(28.6 miles)(1,760 YD/mile)(2 directions) = \$1,816,123.
  - d. Total cost of temporary pavement: \$4,228,224 + \$4,872,525 + \$1,816,123 = \$10,916,872.
- 8. Mill and inlay outside shoulder of the 64-foot median only:
  - a. The average milling cost for 1.5-inch milling is \$1.42/SY; however, this price would be lower since this is a variable depth milling to change the 6% cross slope to 2%. This reduce cost could be about \$1.30/SY. As such: (\$1.30/SY)((2 LF)(1 YD)/3 LF/YD))(9.5 miles)(1,760 YD/mile)(2 directions) = \$28,981.

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

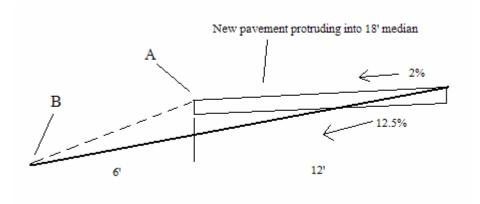
ALTERNATIVE NO.:

7A

DESCRIPTION: SHEET NO.: 7 of 9

### **Calculations continued:**

- b. Divide inlay into (1) a 1.5-inch deep by 6.5-foot long rectangular section and (2) a 3.375-inch deep by 4.5-foot long triangular section. The combined area of these two sections is: (1.5 IN/12 IN/LF)(6.5 LF)+ (3.375 IN/12 IN/LF)(4.5 LF)(0.5) = 1.46 SF. 1.46 SF/9 SF/SY = 0.161 SY. Therefore, (0.161 SY)(9.5 miles)(1,760 YD/mile)(2 directions) = 5,384 CY. Using the 3,960# or 2 tons/CY rate, this provides for (5,384 CY)(2 tons/CY) = 10,768 tons of inlay for the project. Using the current cost of 19mm Superpave for inlay at \$43/ton, this provides (10,768 TN)(\$43.00/TN) = \$463,024.
- c. Total milling and inlay cost is: \$28,981 + \$463,024 = \$491,915.
- 9. Earthwork required if cable guardrail us installed rather then the Type S-1 concrete barrier in the 88-foot median.
  - a. Minimum approach slope for the cable guardrail is 6:1 or flatter. Working with the 8:1 slopes (12/5% or 7.1°) in the 18-feet remaining on the 88-foot median in the current design (see sketch below), the tangent of 7.1° of 6-feet = (tan 7.1°)(6 LF) = 0.746 LF [or about (0.746LF)(12 IN/LF) = 8.95-inches (9-inches)]. Therefore, 0.746 LF + 1.25 LF = 2.00 LF which is the mount of height from point A to point B. The sloped depicted by the dotted line is 33% or 3:1 which will not work for a cable guardrail approach slope. [Calculation not used for 7A.]



b. Calculate fill required to create minimum 6:1 slope which allows a 2-inch drop per foot of run. As such, over 6-feet there is a 1-foot drop [(6.0 LF)(2 IN/12 IN/LF) = 1.0 LF]. Given the starting height, an additional foot of material is needed at point C. (See sketch on next page) [Calculation not used for 7A.]

> INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

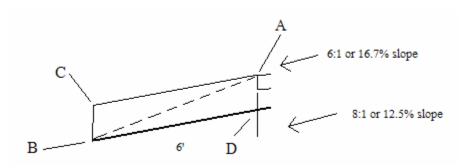
Concept Development

**ALTERNATIVE NO.:** 

7 A

DESCRIPTION: SHEET NO.: 8 of 9

### **Calculations continued:**



c. The asymmetric rhombus ABCD in the sketch above is the fill section required. The area of the rhombus is approximately 6.75 SF. Therefore, the volume of earth required for the 19.1 miles of the 88-foot median is: ((6.75 SF)(1 SY/9SF))(19.1 miles)(1,760 YD/mile)(2 sides) = 50,424 CY.Assuming a cost of \$5.00/CY of fill, the added cost for fill to permit the use of cable guardrail is: (\$5.00/CY)(50,424 CY) = \$252,120. [Calculation not used for 7A.]

Additional asphalt stabilization of two 6-foot "leftover" areas adjacent to the median barriers in the 88-foot median only:

62,400 LF + 34,800 LF = 97,200 LF. (97,200 LF)(6 LF wide)(2 sides) = 1,166,400 LF.(1,166,400 LF)/(9 SF/SY) = 129,600 SY.

Bridge Savings – The additional width of the existing bridges that can be used if the PGL is shifted 12 feet is 10 feet. Therefore, assuming a slab thickness of 8-inches:

- Total bridge length (all directions): Project 161 = 3,002 LF a.
- b. Total bridge length (all directions): Project 246 = 7,065 LF

10.066 LF

- Total volume: [(10 LF)(8 IN/12 IN/LF)(10,066 LF)]/27 CF/CY = 2,485 CYc. (at \$858.88/CY)
- d. Total weight: (2,485 CY)(220#/CY) = 546,700# (at \$1.40/#)

# COST WORKSHEET

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

Concept Development

ALTERNATIVE NO:

7**A** 

DESCRIPTION SHEET NO.: 9 of 9

CONSTRUCTION ITEM		C	RIGINAL E	STIMATE	P	ROPOSED ES	TIMATE
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Barrier:							
Project 161	LF	36,310	60.00	2,178,600	103,053	60.00	6,183,180
Project 246	LF	16,900	60.00	1,014,000	47,965	60.00	2,877,900
<u>Drainage System:</u>							
Project 161 - ditches in 88' median	MI	18.40	27,376	503,718			
Project 161	LS	1		1,856,100			
Project 246	LS	1		1,346,000			
Project 161	MI				13.42	205,123	2,752,751
Project 246	MI				15.11	205,123	3,099,409
Temporary Pavement:							
8" GAB	SY	402,688	10.50	4,228,224			
5" 25mm HMA	SY	402,688	12.10	4,872,525			
2" 19mm HMA	SY	402,688	4.51	1,816,123			
Mill and Inlay Outside Shoulder	LS				1		491,915
Additional Asphalt for "Leftover"	SY				129,600	8.50	1,101,600
Area Adjacent to Barriers							
Bridge Deck Steel	LB	546,700	1.40	765,380			
Bridge Deck Concrete	CY	2,485	858.88	2,134,317			
Sub-total				20,714,987			16,506,754
Mark-up at 20.25%				4,194,785			3,342,618
TOTAL				24,909,772			19,849,372



ALTERNATIVE NO.:

7B

SHEET NO.: 1 of 9

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

DESCRIPTION: SHIFT IMPROVEMENTS TO THE INSIDE AND USE CABLE

GUARDRAIL AND PIPED DRAINAGE SYSTEM IN THE 88-FT.

**MEDIAN** 

**ORIGINAL DESIGN: (Sketch Attached)** 

The original design calls for the addition of 60 ft. of continuous reinforced concrete (CRC) travel lanes in each direction and contains two typical sections; one with an existing 64-ft. median and another with an existing 88-ft. median.

The 64-ft. median cross section calls for the construction of a full-depth, 12.0-ft. wide shoulder on the outside of the existing pavement, a 12.0-ft. lane on the inside, a 12.0-ft. wide full-depth shoulder pavement, and a 16-ft. wide paved median with a concrete median barrier in the center.

The 88-ft. median cross section calls for the construction of a full-depth, 12.0-ft. wide shoulder on the outside of the existing pavement, a 12.0-ft. wide lane on the inside, a 12.0-ft. wide full-depth shoulder pavement, and a 40-ft. wide grassed median.

The widening of this corridor also requires the existing bridges to be reworked to accommodate not only the widening, but correction of the cross slopes as well. New mainline bridge construction will be carried out to the inside of the existing bridges while the existing bridges over the highway will be jacked to allow for a vertical clearance of 17.0 ft.

### **ALTERNATIVE**: (Sketch Attached)

In the 64-ft. median cross section, locate the ultimate section to the inside, reduce the inside shoulder from 19 ft. to 10 ft., and move the PGL 9 ft. to the inside. Shift the outside edge of pavement in 7 ft. of the 9 ft. saved on the inside and use 2 ft. of the 9 ft. saved to provide a 14-ft. wide outside lane striped at 12 ft. to control edge stresses. The existing 6% cross slope full depth shoulder is milled and inlayed to match the 1% cross slope of the existing pavement.

In the 88-ft. median cross section, locate the ultimate section to the inside, reduce the inside shoulder from 30 ft. to 18 ft., and move the PGL 12 ft. to the inside. Shift the outside edge of pavement 10 ft. of the 12 ft. saved on the inside and use 2 ft. of the 12 ft. saved to provide a 14-ft. wide outside lane striped at 12 ft. to control edge stresses. Use a piped drainage system and cable guardrails.

Bridges – There are two sets of existing bridges in Project 246 and all are in an 88-ft. median section. There are seven sets of existing bridges in Project 161; five within the 64-ft. median section, and two within the 88-ft. median section. During Stage 1, construct the new bridges completely on the inside with a 22-ft. travel way width in both directions to the new PGL, stripe for two temporary 11-ft. lanes, and add a 3-ft. section outside of the PGL for placement of Method 4 temporary barrier. During Stage 2, shift traffic to the new bridges and new roadway, remove parapet walls from inside and outside (where required) of old bridges, jack and rotate the existing bridges, connect to new bridges with a pour strip, and reform the outside parapet wall (where required).

COST SUMMARY		INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST	
ORIGINAL DESIGN	\$	24,909,772	3/4	\$	24,909,772
ALTERNATIVE	\$	14,885,741	3/4	\$	14,885,741
SAVINGS	\$	10,024,031	3/4	\$	10,024,031



ALTERNATIVE NO.:

7B

SHEET NO.: 2 of 9

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

DESCRIPTION: SHIFT IMPROVEMENTS TO THE INSIDE AND USE

CONCRETE MEDIAN BARRIERS AND PIPED DRAINAGE

SYSTEM IN THE 88-FT. MEDIAN

### ADVANTAGES:

- More bridge width than needed for three lanes plus shoulders
- Additional width on outside would offset bridge widening when a future 4<sup>th</sup> lane is activated
- Bridge costs are minimized by retaining all old deck and all old beams
- No temporary pavement on outside shoulder is needed
- The outside shoulder in the 88-ft. median section is not disturbed
- Construction process is simpler
- Staging is easier
- Improved aesthetics with cable guardrail

### DISADVANTAGES:

- Virtually all 30-year-old decks are retained, thus the life of old decks are only for another 20 or so years
- Cost increase for 19 miles of concrete barrier
- Cost increase for 19 miles of piped, longitudinal drainage system
- Minimal mill and inlay of outside shoulder needed for cross slope correction in the 64-ft. median section
- Added O&M costs associated with the cable guardrail

### **DISCUSSION:**

The current project concept adds median drainage and concrete barriers for only the 64-ft. wide median sections. The 64-ft. wide median comprises 33% of the entire length of both projects. The 88-ft. median section, which makes up the remaining 67% of the length of both projects, becomes a 36-ft. median with a drainage ditch. The positive barrier separating the directions of travel for the new 36-ft. median would benefit safety and prevent crossover accidents.

This alternative requires a drainage system and cable guardrail on the 88-ft. median sections. Using cable guardrail would increase total barrier cost, especially with the added O&M cost of the system. The cable guardrail function is improved with a piped drainage system. Assuming a 24-in. longitudinal concrete drain pipe and drop inlets every 150 ft. along the barrier wall, we would increase total drainage system cost for both projects. Additionally, some milling and inlay of the outside shoulder along the 64-ft. wide median sections is required. However, the alternative eliminates the temporary pavement.

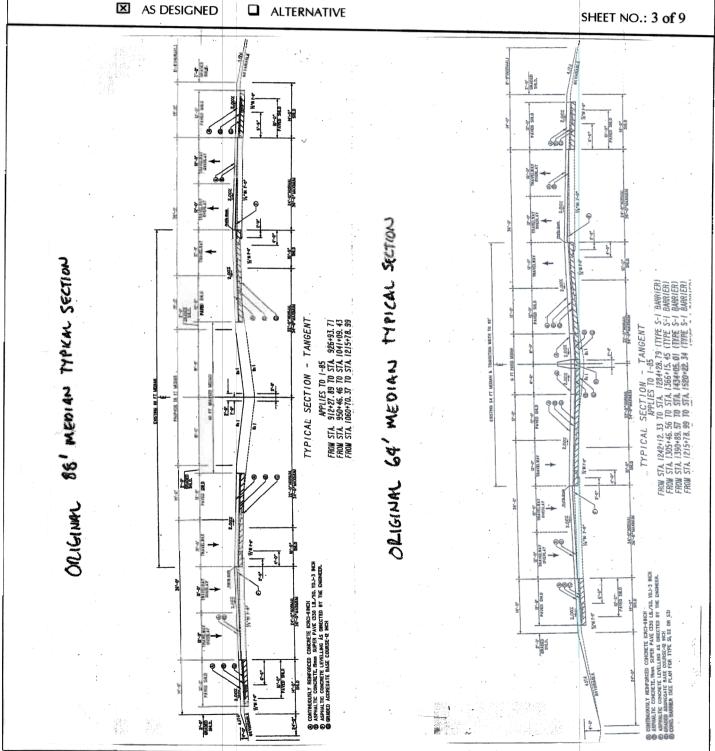
INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

ALTERNATIVE NO .:

7B



INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

**Concept Development** 

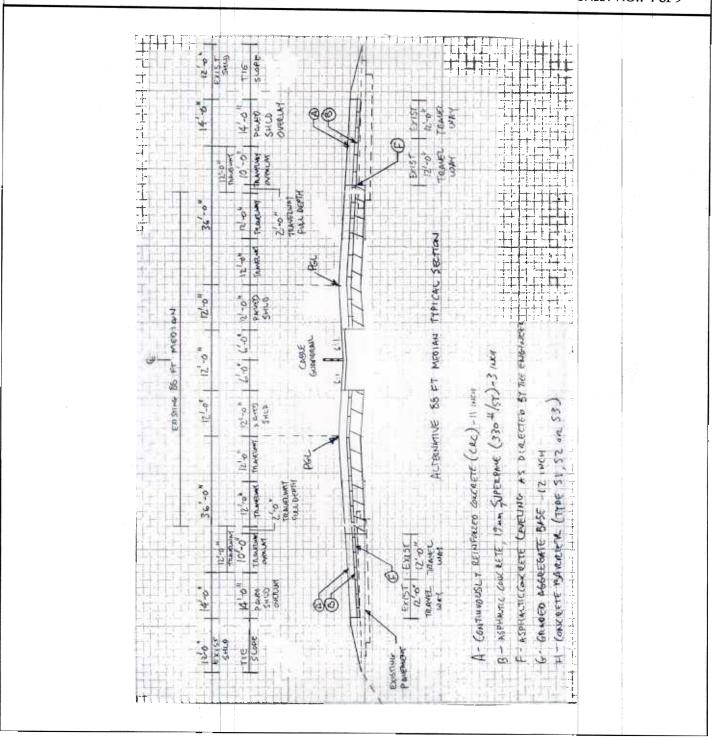
AS DESIGNED.

■ ALTERNATIVE

ALTERNATIVE NO .:

**7B** 

SHEET NO.: 4 of 9



INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

ALTERNATIVE NO.:

7B

DESCRIPTION: SHEET NO.: 5 of 9

### **Assumptions:**

1. Full depth shoulder pavement exists on 6.50 feet of the shoulder per the drawings provided.

- 2. Longitudinal pipe median is 24-inch reinforced concrete (RCP) H1-10 priced at \$38.70/LF. Drop inlets are priced at \$25.00 each.
- 3. Outside shoulder is full depth at a 6% cross slope.

### **Calculations:**

1. Check concept report costs and quantities for both barrier and drainage:

Project	Barrier Quantity	Barrier Cost	Comment	Drainage Cost
246	16,900 LF	Incorrect at	Actual is	\$135,000
240	3.20 miles		\$1,014,000	\$133,000
161	36,310 LF	\$2,179,000	\$2,179,000	\$181,000
101	6.88 miles	\$2,179,000	\$2,179,000	\$101,000
Total	53,210 LF	\$2,460,000	\$3,193,000	\$316,000
Total	10.08 miles	\$2,400,000	φ3,193,000	φ310,000

2. Check Median width quantities for both projects

a. Length measurements taken from Concept Drawings

Project	64-foot Median	88-Foot Median	Transitions	
246	15,800 LF	62,400 LF	1,600 LF	
240	246 2.99 miles 11.82 miles	0.30 miles		
161	34,000 LF	34,800 LF	2,000 LF	
101	6.44 miles	6.59 miles	0.38 miles	
Total	49,800 LF	97,200 LF	3,600 LF	150,600 LF
Total	9.43 miles	18.41 miles	0.68 miles	28.52 miles
Percentage	33.06%	64.55%	2.38%	

- b. Concept Reports state project length is 28.605 miles close agreement. Thus the entire project length for barrier is 150,600 LF. Using cable guardrail Type TL4 in the 88-foot median and corresponding transition is: 97,200 LF + 3,600 LF = 100,800. The remaining 49,800 LF will use Type S1 concrete median barriers.
- 3. Hot Asphalt Mix (HMA) density:
  - a. 1-inch HMA corresponds to a spread rate of 110#/SY.
  - b. 0.028 CY corresponds to a spread rate of 110# in a SY 1-inch thick.
  - c. 110#/0.028 CY = 3,960 #/CY.

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

**ALTERNATIVE NO.:** 

7B

DESCRIPTION: SHEET NO.: 6 of 9

#### **Calculations continued:**

- 4. Determine the cost of installing a pipe drainage system to the entire length of both projects:
  - a. Determine drainage cost of 64-foot median section in Project 161 = (36,310 LF)(\$38.70/LF) = \$1,405,197.
  - b. Determine quantity of drop inlets assuming a 150-foot spacing = (36,310 LF)(150 LF) = 242.06;  $\therefore$  use 242.
  - c. Determine cost of drop inlets = (242 EA)(\$25.00/LF) = \$6,050.
  - d. Total cost of the drainage system in the 64-foot median is \$1,405,197 + \$6,050 = \$1,411,247 of 76% of the Project 161 drainage cost. This applies to 6.88 miles of Project 161. Extrapolating this to the entire 28.60 miles of the both projects is \$1,411,247/6.88 miles = \$205,123/mile; :: (\$205,123/miles)(28.60 miles) = \$5,866,520; the cost to pipe the entire length of both projects.
- 5. Reduce cost of Alternative 7 by the ditches not constructed in the 88-foot median if pipes are considered:
  - a. From Project 161 cost of non-median drainage is \$1,856,100 \$1,411,247 = \$444,853.
  - b.  $\therefore$  (\$444,853)/2.5 = \$177,942. \$177,942/6.50 miles = \$27,376/mile reduction. Therefore, reduction for the 18.4 miles of the 88-foot median not ditched is: (\$27,376/mile)(18.4 miles) = \$503,710.
- 6. Use Alternative 7 the drainage cost of Projects 161 and 246 is \$1,856,100 (for Project 161) + \$1,346,000 (for Project 246) + \$5,866,520 (total cost new drainage system) \$503,710 (reduction for the 88-foot median) = \$8,564,910. This amounts to an overall drainage increase of \$5,362,810.
- 7. Cost of temporary pavement added according to the current concept:
  - a. 8-inch graded aggregate base (GAB) at \$10.50/SY:
    - $\therefore$  (\$10.50/SY)(4 YD)(28.6 miles)(1,760 YD/mile)(2 directions) = \$4,228,224.
  - b. 5-inch, 25 millimeter (mm) HMA at \$44.00/ton, 550#/SY; this equals (550#/2,000#/ton)(\$44.00/ton) = \$12.10/SY)
    - $\therefore$  (\$12.10/SY)(4 YD)(28.6 miles)(1,760 YD/mile)(2 directions) = \$4,872,525.
  - c. 2-inch, 19 millimeter (mm) HMA at \$41.00/ton, 220#/SY; this equals (220#/2,000#/ton)(\$41.00/ton) = \$4.51/SY)
    - $\therefore$  (\$4.51/SY)(4 YD)(28.6 miles)(1,760 YD/mile)(2 directions) = \$1,816,123.
  - d. Total cost of temporary pavement: \$4,228,224 + \$4,872,525 + \$1,816,123 = \$10,916,872.
- 8. Mill and inlay outside shoulder of the 64-foot median only:
  - a. The average milling cost for 1.5-inch milling is \$1.42/SY; however, this price would be lower since this is a variable depth milling to change the 6% cross slope to 2%. This reduce cost could be about \$1.30/SY. As such: (\$1.30/SY)((2 LF)(1 YD)/3 LF/YD))(9.5 miles)(1,760 YD/mile)(2 directions) = \$28,981.

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

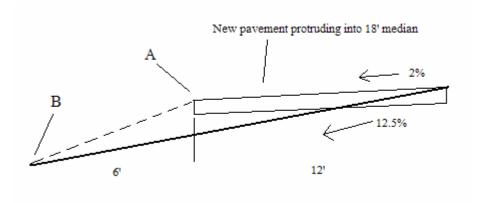
**ALTERNATIVE NO.:** 

7В

DESCRIPTION: SHEET NO.: 7 of 9

#### **Calculations continued:**

- b. Divide inlay into (1) a 1.5-inch deep by 6.5-foot long rectangular section and (2) a 3.375-inch deep by 4.5-foot long triangular section. The combined area of these two sections is: (1.5 IN/12 IN/LF)(6.5 LF)+ (3.375 IN/12 IN/LF)(4.5 LF)(0.5) = 1.46 SF. 1.46 SF/9 SF/SY = 0.161 SY. Therefore, (0.161 SY)(9.5 miles)(1,760 YD/mile)(2 directions) = 5,384 CY. Using the 3,960# or 2 tons/CY rate, this provides for (5,384 CY)(2 tons/CY) = 10,768 tons of inlay for the project. Using the current cost of 19mm Superpave for inlay at \$43/ton, this provides (10,768 TN)(\$43.00/TN) = \$463,024.
- c. Total milling and inlay cost is: \$28,981 + \$463,024 = \$491,915.
- 9. Earthwork required if cable guardrail us installed rather then the Type S-1 concrete barrier in the 88-foot median
  - a. Minimum approach slope for the cable guardrail is 6:1 or flatter. Working with the 8:1 slopes (12/5% or 7.1°) in the 18-feet remaining on the 88-foot median in the current design (see sketch below), the tangent of 7.1° of 6-feet = (tan 7.1°)(6 LF) = 0.746 LF [or about (0.746LF)(12 IN/LF) = 8.95-inches (9-inches)]. Therefore, 0.746 LF + 1.25 LF = 2.00 LF which is the mount of height from point A to point B. The sloped depicted by the dotted line is 33% or 3:1 which will not work for a cable guardrail approach slope.



b. Calculate fill required to create minimum 6:1 slope which allows a 2-inch drop per foot of run. As such, over 6-feet there is a 1-foot drop [(6.0 LF)(2 IN/12 IN/LF) = 1.0 LF]. Given the starting height, an additional foot of material is needed at point C. (See sketch on next page)

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

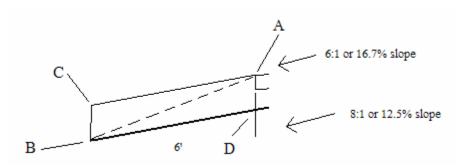
Concept Development

ALTERNATIVE NO.:

7В

DESCRIPTION: SHEET NO.: 8 of 9

### **Calculations continued:**



c. The asymmetric rhombus ABCD in the sketch above is the fill section required. The area of the rhombus is approximately 6.75 SF. Therefore, the volume of earth required for the 19.1 miles of the 88-foot median is: ((6.75 SF)(1 SY/9SF))(19.1 miles)(1,760 YD/mile)(2 sides) = 50,424 CY. Assuming a cost of \$5.00/CY of fill, the added cost for fill to permit the use of cable guardrail is: (\$5.00/CY)(50,424 CY) = \$252,120.

Additional asphalt stabilization of two 6-foot "leftover" areas adjacent to the median barriers in the 88-foot median only:

62,400 LF + 34,800 LF = 97,200 LF. (97,200 LF)(6 LF wide)(2 sides) = 1,166,400 LF. (1,166,400 LF)/(9 SF/SY) = 129,600 SY.

Bridge Savings – The additional width of the existing bridges that can be used if the PGL is shifted 12 feet is 10 feet. Therefore, assuming a slab thickness of 8-inches:

- a. Total bridge length (all directions): Project 161 = 3,002 LF
- b. Total bridge length (all directions): Project  $246 = \frac{7,065 \text{ LF}}{10,066 \text{ LF}}$

10,066 LF

- c. Total volume: [(10 LF)(8 IN/12 IN/LF)(10,066 LF)]/27 CF/CY = 2,485 CY (at \$858.88/CY)
- d. Total weight: (2,485 CY)(220 # / CY) = 546,700 # (at \$1.40 / #)

# COST WORKSHEET

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

Concept Development

ALTERNATIVE NO:

**7B** 

DESCRIPTION SHEET NO.: 9 of 9

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE			
CONSTRUCTION TIEN			1	STIVIATE			TIIVIATE	
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL	
Barrier:								
Project 161	LF	36,310	60.00	2,178,600	34,500	60.00	2,070,000	
Project 246	LF	16,900	60.00	1,014,000	15,800	60.00	948,000	
Cable Barrier TL4	LF				100,800	16.50	1,663,200	
Infill for 6:1 Slope Approach for	CY				50,424	5.00	252,120	
Cable Guardrail in Median								
Drainage System:								
Project 161 - ditches in 88' median	MI	18.40	27,376	503,718				
Project 161	LS	1		1,856,100				
Project 246	LS	1		1,346,000				
Project 161	MI				13.42	205,123	2,752,751	
Project 246	MI				15.11	205,123	3,099,409	
Temporary Pavement:								
8" GAB	SY	402,688	10.50	4,228,224				
5" 25mm HMA	SY	402,688	12.10	4,872,525				
2" 19mm HMA	SY	402,688	4.51	1,816,123				
Mill and Inlay Outside Shoulder	LS				1		491,915	
Additional Asphalt for "Leftover"	SY				129,600	8.50	1,101,600	
Area Adjacent to Barriers								
Bridge Deck Steel	LB	546,700	1.40	765,380				
Bridge Deck Concrete	CY	2,485	858.88	2,134,317				
Sub-total				20,714,987			12,378,994	
Mark-up at 20.25%				4,194,785			2,506,746	
TOTAL				24,909,772			14,885,741	



ALTERNATIVE NO.:

7*C* 

SHEET NO.: 1 of 9

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

DESCRIPTION: SHIFT IMPROVEMENTS TO THE INSIDE AND USE CABLE

GUARDRAIL AND A DITCH DRAINAGE SYSTEM IN THE 88-

FT. MEDIAN

ORIGINAL DESIGN: (Sketch Attached)

The original design calls for the addition of 60 ft. of continuous reinforced concrete (CRC) travel lanes in each direction and contains two typical sections; one with an existing 64-ft. median and another with an existing 88-ft. median.

The 64-ft. median cross section calls for the construction of a full-depth, 12.0-ft. wide shoulder on the outside of the existing pavement, a 12.0-ft. lane on the inside, a 12.0-ft. wide full-depth shoulder pavement, and a 16-ft. wide paved median with a concrete median barrier in the center.

The 88-ft. median cross section calls for the construction of a full-depth, 12.0-ft. wide shoulder on the outside of the existing pavement, a 12.0-ft. wide lane on the inside, a 12.0-ft. wide full-depth shoulder pavement, and a 40-ft. wide grassed median.

The widening of this corridor also requires the existing bridges to be reworked to accommodate not only the widening, but correction of the cross slopes as well. New mainline bridge construction will be carried out to the inside of the existing bridges while the existing bridges over the highway will be jacked to allow for a vertical clearance of 17.0 ft.

### **ALTERNATIVE**: (Sketch Attached)

In the 64-ft. median cross section, locate the ultimate section to the inside, reduce the inside shoulder from 19 ft. to 10 ft., and move the PGL 9 ft. to the inside. Shift the outside edge of pavement in 7 ft. of the 9 ft. saved on the inside and use 2 ft. of the 9 ft. saved to provide a 14-ft. wide outside lane striped at 12 ft. to control edge stresses. The existing 6% cross slope full depth shoulder is milled and inlayed to match the 1% cross slope of the existing pavement.

In the 88-ft. median cross section, locate the ultimate section to the inside, reduce the inside shoulder from 30 ft. to 18 ft., and move the PGL 12 ft. to the inside. Shift the outside edge of pavement 10 ft. of the 12 ft. saved on the inside and use 2 ft. of the 12 ft. saved to provide a 14-ft. wide outside lane striped at 12 ft. to control edge stresses. Use a ditch drainage system and a cable guardrails.

Bridges – There are two sets of existing bridges in Project 246 and all are in an 88-ft. median section. There are seven sets of existing bridges in Project 161; five within the 64-ft. median section, and two within the 88-ft. median section. During Stage 1, construct the new bridges completely on the inside with a 22-ft. travel way width in both directions to the new PGL, stripe for two temporary 11-ft. lanes, and add a 3-ft. section outside of the PGL for placement of Method 4 temporary barrier. During Stage 2, shift traffic to the new bridges and new roadway, remove parapet walls from inside and outside (where required) of old bridges, jack and rotate the existing bridges, connect to new bridges with a pour strip, and reform the outside parapet wall (where required).

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST	
ORIGINAL DESIGN	\$ 24,304,050	3/4	\$	24,304,050
ALTERNATIVE	\$ 12,304,766	3/4	\$	12,304,766
SAVINGS	\$ 11,999,284	3/4	\$	11,999,284



ALTERNATIVE NO.:

7*C* 

SHEET NO.: 2 of 9

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

DESCRIPTION: SHIFT IMPROVEMENTS TO THE INSIDE AND USE CABLE

GUARDRAIL AND A DITCH DRAINAGE SYSTEM IN THE 88-

FT. MEDIAN

### ADVANTAGES:

- More bridge width than needed for three lanes plus shoulders
- Additional width on outside would offset bridge widening when future 4<sup>th</sup> lane is activated
- Bridge costs minimized by retaining all old deck and all old beams
- No temporary pavement on outside shoulder is needed
- The outside shoulder in the 88-ft. medians not disturbed
- Construction process is simpler
- Staging is easier
- Improved aesthetics with cable guardrail

### DISADVANTAGES:

- Virtually all 30-year-old decks are retained, thus life of old decks are only for another 20 or so years
- Cost increase for 19 miles of cable guardrail
- Cost increase for 19 miles of longitudinal ditch drainage system
- Minimal mill and inlay of outside shoulder needed for cross slope correction in the 64-ft. median section
- Added O&M costs associated with the cable guardrail

### **DISCUSSION:**

The current project concept adds median drainage and concrete barrier for only the 64-ft. median sections. The 64-ft. median comprises 33% of the entire length of both projects. The 88-ft. median section, which makes up the remaining 67% of the length of both projects, becomes a 36-ft. median with a drainage ditch. Positive barrier separating the directions of travel for the new 36-ft. median would benefit safety and prevent crossover accidents.

This alternative requires a drainage system and cable guardrail on the 88-ft. median sections. Using cable guardrail would increase total barrier cost; especially with the added O&M cost of the system. The cable guardrail function with a less expensive ditch drainage system as long as the minimum 6:1 slope or flatter approaches are maintained on both sides of the system. Additionally, some milling and inlay of the outside shoulder along the 64-ft. median sections is required. However, the alternative eliminates the temporary pavement.

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 ALTERNATIVE NO.: INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN 7C TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY Coweta, Meriwether, and Troup Counties Concept Development **X** AS DESIGNED □ ALTERNATIVE SHEET NO.: 3 of 9 OPIGINAL 64" MEDIAN TYPICAL SETION 88 MEDIAN TYPKAL SECTION TYPICAL SECTION STA. STA / STA / STA / FROM

INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

**Concept Development** 

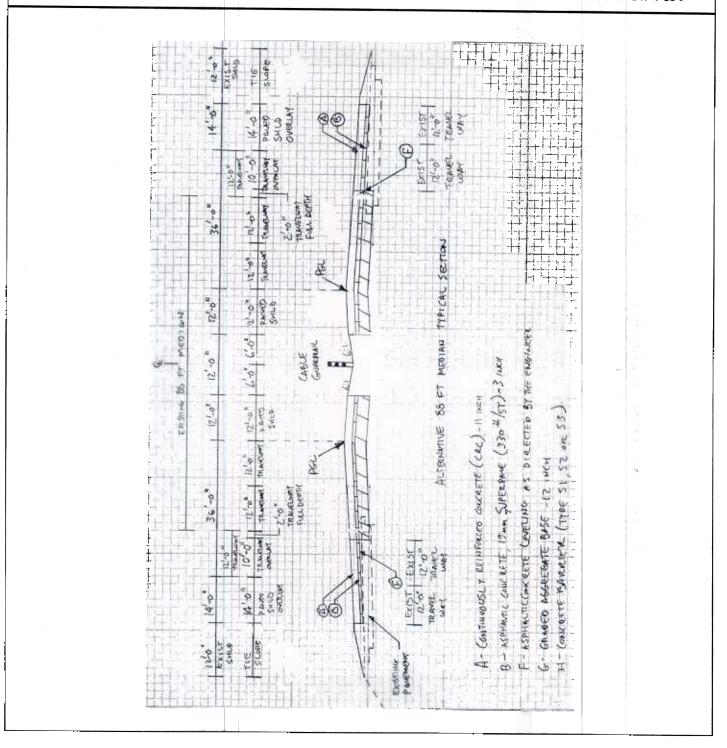
☐ AS DESIGNED

■ ALTERNATIVE

ALTERNATIVE NO.:

7C

SHEET NO.: 4 of 9



INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

Concept Development

ALTERNATIVE NO.:

7C

DESCRIPTION: SHEET NO.: 5 of 9

### **Assumptions:**

1. Full depth shoulder pavement exists on 6.50 feet of the shoulder per the drawings provided.

- 2. Longitudinal pipe median is 24-inch reinforced concrete (RCP) H1-10 priced at \$38.70/LF. Drop inlets are priced at \$25.00 each.
- 3. Outside shoulder is full depth at a 6% cross slope.

### **Calculations:**

1. Check concept report costs and quantities for both barrier and drainage:

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Total	10.08 miles	\$2,400,000	φ3,193,000	φ310,000

2. Check Median width quantities for both projects

a. Length measurements taken from Concept Drawings

Project	64-foot Median	88-Foot Median	Transitions	
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240	246 2.99 miles 11.82 miles	0.30 miles		
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Total	49,800 LF	97,200 LF	3,600 LF	150,600 LF
Total	9.43 miles	18.41 miles	0.68 miles	28.52 miles
Percentage	33.06%	64.55%	2.38%	

- b. Concept Reports state project length is 28.605 miles close agreement. Thus the entire project length for barrier is 150,600 LF. Using cable guardrail Type TL4 in the 88-foot median and corresponding transition is: 97,200 LF + 3,600 LF = 100,800. The remaining 49,800 LF will use Type S1 concrete median barriers.
- 3. Hot Asphalt Mix (HMA) density:
  - a. 1-inch HMA corresponds to a spread rate of 110#/SY.
  - b. 0.028 CY corresponds to a spread rate of 110# in a SY 1-inch thick.
  - c. 110#/0.028 CY = 3,960 #/CY.

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

Concept Development

ALTERNATIVE NO.:

SHEET NO.: 6 of 9

### Calculations continued:

DESCRIPTION:

\*4. Determine the cost of installing a pipe drainage system to the entire length of both projects:

- a. Determine drainage cost of 64-foot median section in Project 161 = (36,310 LF)(\$38.70/LF) = \$1,405,197.
- b. Determine quantity of drop inlets assuming a 150-foot spacing = (36,310 LF)(150 LF) = 242.06; \ use 242.
- c. Determine cost of drop inlets = (242 EA)(\$25.00/LF) = \$6,050.
- d. Total cost of the drainage system in the 64-foot median is \$1,405,197 + \$6,050 = \$1,411,247 of 76% of the Project 161 drainage cost. This applies to 6.88 miles of Project 161. Extrapolating this to the entire 28.60 miles of the both projects is \$1,411,247/6.88 miles = \$205,123/mile; \((\$205,123/miles)(28.60 miles) = \$5,866,520; the cost to pipe the entire length of both projects.
- \*5. Reduce cost of Alternative 7 by the ditches not constructed in the 88-foot median if pipes are considered:
  - a. From Project 161 cost of non-median drainage is \$1,856,100 \$1,411,247 = \$444,853.
- \*6. Use Alternative 7 the drainage cost of Projects 161 and 246 is \$1,856,100 (for Project 161) + \$1,346,000 (for Project 246) + \$5,866,520 (total cost new drainage system) \$503,710 (reduction for the 88-foot median) = \$8,564,910. This amounts to an overall drainage increase of \$5,362,810.
- 7. Cost of temporary pavement added according to the current concept:
  - a. 8-inch graded aggregate base (GAB) at \$10.50/SY:
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  - c. 2-inch, 19 millimeter (mm) HMA at \$41.00/ton, 220#/SY; this equals (220#/2,000#/ton)(\$41.00/ton) = \$4.51/SY)
    - $\therefore$  (\$4.51/SY)(4 YD)(28.6 miles)(1,760 YD/mile)(2 directions) = \$1,816,123.
  - d. Total cost of temporary pavement: \$4,228,224 + \$4,872,525 + \$1,816,123 = \$10,916,872.
- 8. Mill and inlay outside shoulder of the 64-foot median only:
  - a. The average milling cost for 1.5-inch milling is \$1.42/SY; however, this price would be lower since this is a variable depth milling to change the 6% cross slope to 2%. This reduce cost could be about \$1.30/SY. As such: (\$1.30/SY)((2 LF)(1 YD)/3 LF/YD))(9.5 miles)(1,760 YD/mile)(2 directions) = \$28,981.

<sup>\*</sup> Denotes these calculations were not used entirely for 7C.

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

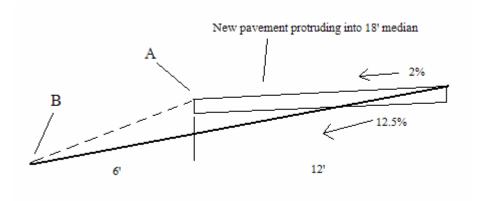
ALTERNATIVE NO.:

7C

DESCRIPTION: SHEET NO.: 7 of 9

#### Calculations continued:

- b. Divide inlay into (1) a 1.5-inch deep by 6.5-foot long rectangular section and (2) a 3.375-inch deep by 4.5-foot long triangular section. The combined area of these two sections is: (1.5 IN/12 IN/LF)(6.5 LF)+ (3.375 IN/12 IN/LF)(4.5 LF)(0.5) = 1.46 SF. 1.46 SF/9 SF/SY = 0.161 SY. Therefore, (0.161 SY)(9.5 miles)(1,760 YD/mile)(2 directions) = 5,384 CY. Using the 3,960# or 2 tons/CY rate, this provides for (5,384 CY)(2 tons/CY) = 10,768 tons of inlay for the project. Using the current cost of 19mm Superpave for inlay at \$43/ton, this provides (10,768 TN)(\$43.00/TN) = \$463,024.
- c. Total milling and inlay cost is: \$28,981 + \$463,024 = \$491,915.
- 9. Earthwork required if cable guardrail us installed rather then the Type S-1 concrete barrier in the 88-foot median
  - a. Minimum approach slope for the cable guardrail is 6:1 or flatter. Working with the 8:1 slopes (12/5% or  $7.1^{\circ}$ ) in the 18-feet remaining on the 88-foot median in the current design (see sketch below), the tangent of  $7.1^{\circ}$  of 6-feet =  $(\tan 7.1^{\circ})(6 \text{ LF}) = 0.746 \text{ LF}$  [or about (0.746 LF)(12 IN/LF) = 8.95-inches (9-inches)]. Therefore, 0.746 LF + 1.25 LF = 2.00 LF which is the mount of height from point A to point B. The sloped depicted by the dotted line is 33% or 3:1 which will not work for a cable guardrail approach slope.



b. Calculate fill required to create minimum 6:1 slope which allows a 2-inch drop per foot of run. As such, over 6-feet there is a 1-foot drop [(6.0 LF)(2 IN/12 IN/LF) = 1.0 LF]. Given the starting height, an additional foot of material is needed at point C. (See sketch on next page)

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

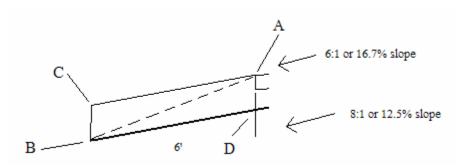
Concept Development

ALTERNATIVE NO.:

7C

DESCRIPTION: SHEET NO.: 8 of 9

### **Calculations continued:**



c. The asymmetric rhombus ABCD in the sketch above is the fill section required. The area of the rhombus is approximately 6.75 SF. Therefore, the volume of earth required for the 19.1 miles of the 88-foot median is: ((6.75 SF)(1 SY/9SF))(19.1 miles)(1,760 YD/mile)(2 sides) = 50,424 CY. Assuming a cost of \$5.00/CY of fill, the added cost for fill to permit the use of cable guardrail is: (\$5.00/CY)(50,424 CY) = \$252,120.

Additional asphalt stabilization of two 6-foot "leftover" areas adjacent to the median barriers in the 88-foot median only:

62,400 LF + 34,800 LF = 97,200 LF. (97,200 LF)(6 LF wide)(2 sides) = 1,166,400 LF. (1,166,400 LF)/(9 SF/SY) = 129,600 SY.

Bridge Savings – The additional width of the existing bridges that can be used if the PGL is shifted 12 feet is 10 feet. Therefore, assuming a slab thickness of 8-inches:

- a. Total bridge length (all directions): Project 161 = 3,002 LF
- b. Total bridge length (all directions): Project  $246 = \frac{7,065 \text{ LF}}{10,066 \text{ LF}}$

10,066 LF

- c. Total volume: [(10 LF)(8 IN/12 IN/LF)(10,066 LF)]/27 CF/CY = 2,485 CY (at \$858.88/CY)
- d. Total weight: (2,485 CY)(220 # / CY) = 546,700 # (at \$1.40 / #)

# COST WORKSHEET

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

Concept Development

ALTERNATIVE NO:

7C

DESCRIPTION SHEET NO.: 9 of 9

CONSTRUCTION ITEM ORIGINAL ESTIMATE PROPOSED ESTIMATE

CONSTRUCTION ITEM		C	RIGINAL E	STIMATE	PROPOSED ESTIMAT		TIMATE
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Barrier:							
Project 161	LF	36,310	60.00	2,178,600	34,500	60.00	2,070,000
Project 246	LF	16,900	60.00	1,014,000	15,800	60.00	948,000
Cable Barrier TL4	LF				100,800	16.50	1,663,200
Infill for 6:1 Slope Approach for	CY				50,424	5.00	252,120
Cable Guardrail in Median							
Drainage System:							
Project 161 - ditches in 88' median	MI				18	27,376.00	503,718
Project 161	LS	1		1,856,100			
Project 246	LS	1		1,346,000			
Project 161	LS				1		1,856,100
Project 246	LS				1		1,346,000
Temporary Pavement:							
8" GAB	SY	402,688	10.50	4,228,224			
5" 25mm HMA	SY	402,688	12.10	4,872,525			
2" 19mm HMA	SY	402,688	4.51	1,816,123			
Mill and Inlay Outside Shoulder	LS				1		491,915
Additional Asphalt for "Leftover"	SY				129,600	8.50	1,101,600
Area Adjacent to Barriers							
Bridge Deck Steel	LB	546,700	1.40	765,380			
Bridge Deck Concrete	CY	2,485	858.88	2,134,317			
Sub-total				20,211,268			10,232,653
Mark-up at 20.25%				4,092,782			2,072,112
TOTAL				24,304,050			12,304,766



PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUPE COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

DESCRIPTION: MAINTAIN 16.0 FT. MINIMUM VERTICAL CLEARANCE

ALTERNATIVE NO.:

8

SHEET NO.: 1 of 5

### **ORIGINAL DESIGN:**

The original design calls for jacking all overhead bridges to provide a 17.0 ft. vertical clearance over the continuous reinforced concrete (CRC) slab, which is being placed over the existing pavement.

#### ALTERNATIVE:

Provide a 16.0 ft. minimum vertical clearance per U. S. Department of Transportation, Federal Highway Administration's (FHWA) standards/guidelines. This will require lowering the existing roadway surface at bridge locations.

### ADVANTAGES:

- Eliminates bridge jacking
- Alleviates tie-ins with existing ramps if any
- Simplifies design and construction
- Improves constructibility

### **DISADVANTAGES:**

- Requires concrete removal and disposal
- Eliminates the use of existing roadway as a base at these locations only

### **DISCUSSION:**

Grading a length under the overhead bridges to accept a 12-in. base course, 3-in. asphaltic concrete overlay, and an 11-in. CRC will require removal of the existing concrete and base for approximately 700 lf at each location to provide the 16.0-ft. vertical clearance required by the FHWA. This effort precludes jacking the existing overhead bridges. Keeping the minimum clearance at 16.0 ft. is acceptable since the concrete slab will not require an overlay.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST	
ORIGINAL DESIGN	\$ 2,669,694	3/4	\$	2,669,694
ALTERNATIVE	\$ 719,992	3/4	\$	719,992
SAVINGS	\$ 1,949,702	3/4	\$	1,949,702

### CALCULATIONS



PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

ALTERNATIVE NO .:



DESCRIPTION:

SHEET NO .: 2 of

ADDITIONAL HEIGHT BUE TO INCREASE IN SUPERIEVATION:

ASE = (0.02 - 0.0104)(24') = 0.2304'

ASPHALTIC OVERLAY = 0.25'

CRC SLAPS = 0.9167'

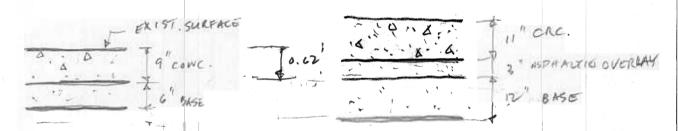
TOTAL = 0.7304'+0.25'+0.9167" = 1.3971 = 17" - 1'e"

MAXIMUM EXIST, MIN. WERS, CLEAR IS ONLY 17/3". THEREFORE, ALL

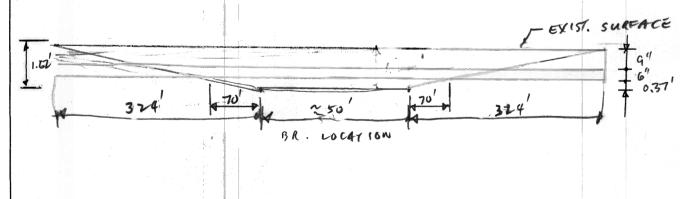
BRIDGE SITES ARE AFFECTED, AVENAGED CLEARANCE IS 16.78'

IF IC MIN IS ADOPTED, THE ROAD HAS TO BE OROPPED BY

17.4' - (14.78'- 16') = 0.62' ... ADD 12" BYSE COURSE SINCE 6" IS IN ADD OUTED



THAT THE AMOUNT CAN FEATHER OUT AT 1/27. SCUPE:



### CALCULATIONS



PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 ALTERNATIVE NO.: INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY Coweta, Meriwether, and Troup Counties Concept Development **DESCRIPTION:** SHEET NO .: 多of 与 ASSUME BRISTING PAVENENT 13 35' WIDE CONCRETE REMOVAL 35' x 2 0100 CTEUNS y (50'+ 2x324') x 0.75' = 1357.22 CYD. 27 CF4/CY0 BASE COURSE REMOVAL & DISPOSAL 35 ×2 01000 (1145 × (50+2×324) + 0.5' = 904.81 CYD. 27 CPT/C10 UNCLASSIFIED EXCAVATION & DISPOSAL 36' x 2 DIRECTIONS x (50+ 0.5x 70' x 2-) = 311.11010. 27 cor/c40 TOTAL QUANTITIES ASSUME II BRIDGES CONCRETE REMOVAL & DISPOSAL 11 LUCATIONS & 1357.22 CYD = 14,929,42 CYD BASE COURSE REMOVAL & DISPOSAL 11 LOCATIONS X GOFIST CYD = 9,957.91 040 UNCLESSIFIED EXCAVATION & DISPOSAL 11 LOCATIONS V 311.11 CHO = 3,422.22 000. COST ASSUMPTIONS (D WAIT COST FUR CONC. REMOVAL + DISPOSAL (GOUT EST) = \$25.00 /CYD WANT CUST FOR BASE COURSE REMOVAL AND DISPOSAL = \$6.00 /040. (USETWICE UNCLASSIFIED EXCAVATION) = \$ 3.00 /c40 (3) MNC CASSIFIED OXCAVATION

## CALCULATIONS



PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

ALTERNATIVE NO .:

DESCRIPTION:

SHEET NO .: 4 of 5

ADDITIONAL BASE AGEREGATE

35' x 2 DIRECTUDNS x (50'+ 2x70') x 1.0'
27 CFT /CYD

= 492.59 CYO.

TOTAL QUANTITY

11 LOCATIONS X 492.59 CYDS X 2 TONS/CYD

= 10,837 . 04 TONS.

CUST ASSUMPTION

G GRADED AGGREGATE BASE 12"

=\$13.40/TON

# COST WORKSHEET

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

Concept Development

**ALTERNATIVE NO:** 

8

DESCRIPTION SHEET NO.: 5 of 5

CONSTRUCTION ITEM		C	ORIGINAL E	STIMATE	PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
PROJECT 246							
Bridge Jacking:							
Bridge 10	LS	1	164,115	164,115			
Bridge 9	LS	1	164,115	164,115			
Bridge 7	LS	1	177,090	177,090			
Bridge 6	LS	1	172,440	172,440			
Bridge 8	LS	1	232,560	232,560			
Bridge 5	LS	1	208,245	208,245			
Bridge 4	LS	1	164,115	164,115			
Bridge 3	LS	1	172,440	172,440			
PROJECT 161							
Bridge Jacking:							
Bridge 5	LS	1	277,000	277,000			
Bridge 8	LS	1	234,000	234,000			
Bridge 9	LS	1	254,000	254,000			
Unclassified Excavation & Disposal	CY				3,422	6.00	20,532
Base Course Removal & Disposal	CY				9,958	6.00	59,748
Concrete Removal & Disposal	CY				14,930	25.00	373,250
Graded Aggregate 12"	TN				10,837	13.40	145,216
Sub-total				2,220,120			598,746
Mark-up at 20.25%				449,574			121,246
TOTAL				2,669,694			719,992



PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

ELIMINATE THE NEW GAME/RIGHT-OF-WAY FENCE

ALTERNATIVE NO.:

11

SHEET NO.: 1 of 2

### **ORIGINAL DESIGN:**

DESCRIPTION:

The current contract documents call for replacement of the existing right-of-way/game fence for the entire length of the two projects.

#### ALTERNATIVE:

Retain the existing right-of-way/game fence and eliminate the new fencing.

### ADVANTAGES:

- Reduces initial cost
- Possibly reduces construction time
- Takes advantage of an existing asset
- Requires work near or at the edge of the right-of-way

### DISADVANTAGES:

- Height of existing fence not as tall as proposed fence
- Creates a potential aesthetic issue
- May be damaged during construction

### **DISCUSSION:**

Although the new fencing would add a foot of height in an attempt to further preclude large, indigenous wildlife from entering the highway, this is highly unlikely. The issue of aesthetics can be mitigated if a portion of the existing fencing is in poor shape. Then only those portions need to be replaced. However, the VE team was led to believe the existing fence is in good shape for the entire route. This alternative allows for 10% of the fence to be replaced if damaged or in poor shape.

COST SUMMARY	INITIAL COST		PRESENT WORTH RECURRING COSTS		PRESENT WORTH LIFE-CYCLE COST	
ORIGINAL DESIGN	\$	4,485,229	3/4	\$	4,485,229	
ALTERNATIVE	\$	448,523	3/4	\$	448,523	
SAVINGS	\$	4,036,706	3/4	\$	4,036,706	

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

Concept Development

ALTERNATIVE NO:

11

DESCRIPTION SHEET NO.: 2 of 2

511E1 NO. 2 01 2								
CONSTRUCTION ITEM		C	ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL	
Fence, R/W, Game (161)	LF	144,000	12.40	1,785,600	14,400	12.40	178,560	
Fence, R/W, Game (246)	LF	156,800	12.40	1,944,320	15,680	12.40	194,432	
Sub-total				3,729,920			372,992	
Mark-up at 20.25%				755,309			75,531	
TOTAL				4,485,229			448,523	



PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUPE COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

DO NO WORK ON THE BIG POPLAR ROAD BRIDGE

ALTERNATIVE NO.:

12

SHEET NO.: 1 of 2

### **ORIGINAL DESIGN:**

DESCRIPTION:

The design calls for jacking up the Big Poplar Road bridge over I-85. The bridge is to be raised 0.58 ft.

#### ALTERNATIVE:

The work on this bridge should be foregone at this time. There is a project in the planning stages to replace this bridge and build a new interchange at this site. This interchange project takes place within a similar time frame.

### ADVANTAGES:

- Saves initial cost
- Simplifies current workload

### **DISADVANTAGES:**

 Acceptable vertical clearance will not be achieved until the full bridge replacement is done

### **DISCUSSION:**

The current project is so extensive that it must be broken into several contracts to make sure that the flow of work is compatible with the needs of the driving public and that the various scopes of work will suit contractor construction capabilities. It would seem appropriate to make the bridge work a part of the separate project planned for the entire, new Big Poplar Road interchange. This should help un-complicate the current construction phasing choices.

COST SUMMARY	INITIAL COST		PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST	
ORIGINAL DESIGN	\$	281,385	3/4	\$	281,385
ALTERNATIVE	\$	0	3/4	\$	0
SAVINGS	\$	281,385	3/4	\$	281,385

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

Concept Development

ALTERNATIVE NO:

12

DESCRIPTION SHEET NO.: 2 of 2

CONSTRUCTION ITEM	CONSTRUCTION ITEM ORIGINAL			STIMATE	PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Bridge 8 Big Poplar Road Over I-85	LS	1	234,000	234,000			
STA 1481+68.3 - Jacking							
Sub-total				234,000			
Mark-up at 20.25%				47,385			
TOTAL			-	281,385			



ALTERNATIVE NO.:

13

SHEET NO.: 1 of 1

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

DESCRIPTION: BUILD THE BIG POPLAR ROAD BRIDGE TO FUTURE

INTERCHANGE STANDARDS AS PART OF THESE

**PROJECTS** 

### ORIGINAL DESIGN:

The design calls for jacking the bridge up to provide the desired 17 ft. of vertical clearance. There is a project in planning for reconstruction of this entire interchange, including the addition of diamond ramps and replacement of the bridge.

#### ALTERNATIVE:

The current project would replace the Big Poplar Road bridge and construct it to the desired, future interchange standards.

#### ADVANTAGES:

- The cost of jacking would not be wasted
- Constructs the new bridge at a time when mainline traffic is being shifted left and right, helping to facilitate bridge replacement

#### **DISADVANTAGES:**

Adds cost to current project

### **DISCUSSION:**

Including the bridge replacement in the current scope of work will help avoid the perception that GDOT barely finishes one disruptive project before starting another at the same site. Building the bridge now means that ramp construction on the future project will have little or no effect on the mainline travel.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE	D	ESIGN SUGGESTION	1
SAVINGS			



PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

DESCRIPTION: MAKE THE BIG POPLAR ROAD INTERCHANGE A PART OF

**CURRENT PROJECTS** 

ALTERNATIVE NO.:

14

SHEET NO.: 1 of 1

### **ORIGINAL DESIGN:**

The design calls for jacking the bridge up to provide the desired 17 ft. of vertical clearance. There is a project in planning for reconstruction of this entire interchange, including the addition of diamond ramps and replacement of the bridge.

### ALTERNATIVE:

The scope of the current project would be enlarged to encompass the construction of a new diamond interchange at the Big Poplar Road location.

### **ADVANTAGES:**

- Obviates the requirement for jacking the existing bridge (bridge would be replaced)
- Avoids the perception that GDOT barely finishes one disruptive project before starting another at the same site

### **DISADVANTAGES:**

- Adds cost to this project
- Possibly complicates the phasing of work on the current project

### DISCUSSION:

Probably the most important benefit of this alternative is to make it possible to leave a completely finished segment of I-85 when these projects are completed.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE	D	ESIGN SUGGESTION	J
SAVINGS			



PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

DESCRIPTION: USE PRE-WELDED REINFORCING MATS IN LIEU OF HAND-

TIED MATS FOR PAVEMENT REINFORCEMENT

ALTERNATIVE NO.:

15

SHEET NO.: 1 of 1

### **ORIGINAL DESIGN:**

The design is not far enough along to comment on how the continuous reinforced concrete (CRC) steel reinforcing mats will be prepared.

#### ALTERNATIVE:

As the design progresses, consideration should be given to work methods employed to prepare the steel reinforcing mats. In some instances, off-site pre-fabrication of steel reinforcing mats has significantly expedited the daily production on-site. While this is a means and methods matter for the contractor, GDOT and their consultants should determine what their stance will be as to what types of mats will be acceptable and include them in the specifications.

### **ADVANTAGES:**

- Possibly reduces the overall construction bids
- Possibly expedites project delivery

### **DISADVANTAGES:**

 Requires some technical time for the designers and reviewers of this project

### DISCUSSION:

This is an instance where the contractor can probably be expected to submit a Value Engineering Change Proposal (VECP) and receive a reward for his creativity. The specifications could be written to permit this work method if it is researched and found to be acceptable by the GDOT project delivery team.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE	D	DESIGN SUGGESTION	1
SAVINGS			



PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

DESCRIPTION: USE A THINNER PAVEMENT SECTION WHILE

MAINTAINING OPERATIONAL REQUIREMENTS

20, 22, 23

ALTERNATIVE NO.:

SHEET NO.: 1 of 2

### **ORIGINAL DESIGN:**

The current project calls for a pavement section comprised of: 11 in. of continuous reinforced concrete (CRC); 3 in. of asphaltic concrete Superpave (19 mm aggregate size; spread rate of 330 lbs/sy); asphaltic concrete leveling course; and a 12-in. graded aggregate base course.

### **ALTERNATIVE:**

It may be possible to use a thinner pavement section by addressing the depth of the CRC. Three possible solutions are: (1) using higher strength concrete with higher strength steel; (2) using higher strength concrete with current strength steel; and (3) using current concrete strength with higher strength steel.

### **ADVANTAGES:**

- Potentially reduces initial cost
- Potentially reduces the quantity of required concrete (an expensive material that has continued to increase in price)
- Easier to repair if damaged
- Possibly precludes jacking of bridges

### **DISADVANTAGES:**

- None of the potential solutions have been fully tested in the field
- Possibly reduces pavement longevity
- Requires higher costly materials
- Increases risks

### **DISCUSSION:**

The potential of a thinner pavement section warrants exploration due to the potential savings associated with the cost of concrete at \$49.50/sy. A reduction of even 0.5 in. for almost 60 miles of roadway could amount to over \$5,600,000 (see attached cost sheet).

COST SUMMARY	INITIAL COST		PRESENT WORTH RECURRING COSTS	 RESENT WORTH FE-CYCLE COST
ORIGINAL DESIGN	\$	124,028,031	3/4	\$ 124,028,031
ALTERNATIVE	\$	118,390,389	3/4	\$ 118,390,389
SAVINGS	\$	5,637,642	3/4	\$ 5,637,642

# COST WORKSHEET

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

Concept Development

**TOTAL** 

ALTERNATIVE NO: 20, 22, 23

118,390,389

DESCRIPTION SHEET NO.: 2 of 2 **CONSTRUCTION ITEM ORIGINAL ESTIMATE** PROPOSED ESTIMATE NO. OF COST/ NO. OF COST/ UNITS TOTAL ITEM TOTAL **UNITS UNIT UNITS UNIT** Project 161 CRC 11" Shoulder 248,083 SY49.50 12,280,109 CRC 11" Overlay 382,395 18,928,553 SY49.50 SY382,395 49.50 18,928,553 CRC 11" New Project 246 11,662,200 CRC 11" Shoulder SY235,600 49.50 CRC 11" Overlay SY417,600 49.50 20,671,200 CRC 11" New SY417,600 49.50 20,671,200 Project 161 11,721,921 CRC 10.5" Shoulder 236,806 49.50 SYCRC 10.5" Overlay SY365,013 49.50 18,068,163 49.50 CRC 10.5" New SY365,013 18,068,163 Project 246 CRC 10.5" Shoulder 224,891 49.50 SY11,132,100 SY398,618 49.50 19,731,599 CRC 10.5" Overlay CRC 10.5" New SY398,618 49.50 19,731,599 11'' = 0.355556 yd 10.5" = 0.2916667 yd \*: Use a factor of (0.2916667/0.355556 =) 0.9545454525 to reduce the quantity of concrete in this alternative. Sub-total 103,141,814 98,453,546 20.25% Mark-up at 20,886,217 19,936,843

124,028,031



PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

DESCRIPTION: INCREASE CONTINUOUS REINFORCED CONCRETE

THICKNESS AND INCREASE REINFORCING BARS SPACING

ALTERNATIVE NO.:

21

SHEET NO.: 1 of 1

### **ORIGINAL DESIGN:**

The current projects calls for a pavement section comprised of 11- in. of continuous reinforced concrete (CRC); 3 n. of asphaltic concrete Superpave (19 mm aggregate size; spread rate of 330 lbs/sy); asphaltic concrete leveling course; and a 12-in. graded aggregate base course.

### **ALTERNATIVE:**

In an effort to reduce the amount of steel required for the CRC's reinforcing, consider nominally increasing the CRC's thickness and increasing the spacing of the reinforcing bars.

### **ADVANTAGES:**

- Reduces the quantity of required steel (an expensive material that has continued to increase in price)
- Stronger overall section
- Possibly increases longevity

### **DISADVANTAGES:**

- Increases the quantity of required concrete (an expensive material that has continued to increase in price)
- Not tested in the field
- Increases risk

### **DISCUSSION:**

The cost of steel has continued to increase over the past three to four years but immediate relief is in sight. As such, if the required reinforcing steel for the CRC were to be reduced, savings of this costly material could be reduced. On the other hand, the quantity of concrete (a material that is also increasing in price) would have to increase to off-set some structural deficiencies due to the reduction in the quantity of steel.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE	Γ	DESIGN SUGGESTION	N
SAVINGS			



PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

DESCRIPTION: USE PAVEMENT "TURNDOWN" TO REDUCE FULL DEPTH

SHOUDLER WIDTH

ALTERNATIVE NO.:

24

SHEET NO.: 1 of 5

### **ORIGINAL DESIGN:**

The State of Georgia Department of Transportation (GDOT) has a policy on roadways of this nature, which is to add an extra 2 ft. of width on paved shoulders to reduce the vulnerability to edge breakage. This results in a 14-ft. wide, full-depth paved shoulder.

### ALTERNATIVE:

Use a "turndown" slab with reinforcing in the foot of the turned downed edge to eliminate the additional 2 ft. of full-depth paved shoulder. The thickened slab will reduce the edge-of-pavement problems currently being experience by GDOT. Full-depth paved shoulders are reduced to a 12-ft. width.

### **ADVANTAGES:**

- Saves initial cost
- Adds slab strength where needed
- Minimizes edge-of-pavement problems

### **DISADVANTAGES:**

- Slightly complicates construction
- Not a GDOT standard
- Could be more difficult to expand to the outside in the future

### **DISCUSSION:**

The idea of a thickened/"turndown" edge of pavement is derived from structural slabs-on-grade (SOG) as standard practice that accept super-imposed vertical loads without damage to the slab while maintaining the structural integrity of the SOG. Since the anticipated load on the paved shoulder is at the outside edge, the thickened edge concept should perform as intended and reduce the width of the outside shoulders.

It is noted the cost savings may be reduced if the new concrete "turndown" cannot be formed in a crisp manner – see the imbedded sketch on Sheet 3 of 5.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	RESENT WORTH IFE-CYCLE COST
ORIGINAL DESIGN	\$ 409,475	3/4	\$ 409,475
ALTERNATIVE	\$ 0	3/4	\$ 0
SAVINGS	\$ 409,475	3/4	\$ 409,475

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 ALTERNATIVE NO.: INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN 24 TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY Coweta, Meriwether, and Troup Counties **Concept Development AS DESIGNED ALTERNATIVE** SHEET NO.: 2 of 5 11" CRC 2.0 XS DESIGNED EXTRA WIDTH hol 11" CRC ALTERNATIVE

## CALCULATIONS



PROJECT:

MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403 / I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

**ALTERNATIVE NO.:** 

24

**DESCRIPTION:** 

SHEET NO .: 3 of 5

PRELIMINARY DESIGN SHOWS, FOR 11" CRC SLAB, THAT
TRANSVERSE REBAR WILL BE #6 BARS SPACED
AN ASSUMED AVERAGE OF 2'.

FURTHER ASSUMPTIONS:

O WILL MOVE LONGITUDINAL EDGE REINFORCING TO CORRESPONDING LOCATION AT NEW EDGE

ORIG,

ALT.

NEW REBAR ADDED

(3) NEW BOTTOM REBAR

= OLD REBAR (TRANSVERSE

AND LONGITUDINAL)

REDISTRIBUTED

3 COST SAVINGS IS IN THE
CONCRETE SAVED. MAY BE REDUCED

IF CONCRETE TURNDOWN NOT VERTICAL

ON THE INSIDE, I.E.,



25



## CALCULATIONS



PROJECT:

MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF \$R 403 / I-85 FROM NORTH OF \$R 109 IN TROUP COUNTY TO NORTH OF \$R 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

ALTERNATIVE NO .:

24

**DESCRIPTION:** 

SHEET NO.: 4 of 5

PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

Concept Development

ALTERNATIVE NO:

24

 DESCRIPTION

 CONSTRUCTION ITEM
 ORIGINAL ESTIMATE
 PROPOSED ESTIMATE

 ITEM
 UNITS
 NO. OF UNITS
 COST/UNITS
 TOTAL
 NO. OF UNITS
 COST/UNITS
 UNIT
 TOTAL

ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Concrete	CY	8,513	40.00	340,520			
		ļ					
Sub-total				340,520			
Mark-up at 20.25%				68,955			
TOTAL				409,475			

### PROJECT DESCRIPTION

### **NEEDS AND PURPOSES**

Project MSL-0003-00(161), P.I. No. 0003161

The need and purpose for the widening of [United States Interstate Highway (I)] I-85 is that the Level of Service will drop to level "E" in the year 2022 and down to level "F" in the year 2026. Provided that I-85 is a major transportation facility that is vital to the economic stability of Georgia and to all states to which this route provides access, this project should be implemented. Furthermore, the widening of the shoulders on the inside and outside lanes will serve to mitigate current hazards as well as prevent future hazards as traffic volumes increase. The raising of the three bridges for SR 16, Big Poplar Road, and Lower Fayetteville Road should be addressed to meet the minimum height requirements.

Project MSL-0003-00(246), P.I. No. 0003246

This project is justified in anticipation of a tremendous traffic increase while at the same tome providing a safer driving environment. I-85 is a major facility both to metropolitan Atlanta and the southeastern United States. This facility is used for numerous reasons including commercial goods movement, professional commutes, and interstate travel. Further traffic projections indicate that future roadway demand will exceed existing carrying capacity and therefore the corridor will need to be widened to eight lanes by the year 2020. The tremendous population growth and recent development trends in these counties also suggest the need for improvement of this facility. The widening of I-85 in this corridor from four to six lanes with the addition of an auxiliary lane from I-85 to State Route (SR) 54/SR 100 will serve current and future travel demand and provide a safer driving environment along this segment of roadway.

### DESCRIPTIONS OF THE PROPOSED PROJECTS

### Project MSL-0003-00(161), P.I. No. 0003161

This project proposes an inside widening of 13.66 miles of SR 403/United State Interstate Highway (I) 85 from north of Forest Road (Mile Post (M.P.) No. 33.259) in Meriwether County to north of SR 34 (M.P. No. 46.914) in Coweta County. When completed, the project will provide three 12-ft. lanes and 14-ft. inside and outside shoulders (12-ft. paved) in each direction divided with a variable-width (40-ft. to 64-ft.) depressed grass median. This project includes the inside widening of bridges over SR 14/CSX Railroad (sufficient rating – 75.54/HS-15 loading), Bethlehem Church Road (sufficient rating – 88.05/HS-15 loading), CSX Railroad (sufficient rating – 82.96/HS-15 loading), SR 14/US 27 (alternate sufficient rating – 94.51/HS-15 loading), Turkey Creek Road (sufficient rating – 91.27/HS-15 loading), CSX Railroad (sufficient rating – 91.27/HS-15 loading), and SR 34 (sufficient rating – 93.77/HS-15 loading). The project further includes raising (jacking) of bridges on SR 16, Big Poplar Road, and Lower Fayetteville Road, over I-85 to improve vertical clearances to a minimum of 17 ft. The project improves the exiting pavement cross slope to 2.00% by rotating the existing bridge decks on I-85 under traffic. Further, the project will provide one closed circuit television (CCTV) remote controlled camera per direction at each interchange.

### Project MSL-0003-00(246), P.I. No. 0003246

This project proposes an inside widening of 14.947 miles of SR 403/I-85 from north of SR 109 (M.P. No. 18.312) in Troup County to north of Forest Road (M.P. No. 33.259) in Meriwether County. When completed, the project will provide three 12-ft. lanes and 14-ft. inside and outside shoulders (12-ft. paved), in each direction divided with a variable width (40-ft. to 64-ft.) depressed grass median. This project includes the replacements of existing bridges over Beach Creek (sufficient rating – 77.50/HS-15 loading), and Flat Creek (sufficient rating – 77.50/HS-15 loading). The project further includes raising (jacking) of bridges on I-85 northbound (NB)/I-85 southbound (SB), I-85 SB/I-185 SB, Hines Road, Hogansville Road, SR 54, Sims Road, Sewell Road, and Forest Road over I-85 to improve vertical clearances to a minimum of 17 ft. The project improves the existing pavement cross slope to 2.00% using variable depth asphaltic overlay. The project will provide one CCTV remote controlled camera per direction at each interchange.

### **COST DATA**

### Project MSL-0003-00(161), P.I. No. 0003161

The current probable cost of construction is \$119,894,126 as noted on the MLS-0003(161) – PI# 0003161 Cost Estimate, Meriwether/Coweta Counties, contained in the undated Project Concept Report. The project contains inflation at 5.00% per annum for two years (10.25%) and Engineering and Construction of 10.00%.

### Project MSL-0003-00(246), P.I. No. 0003246

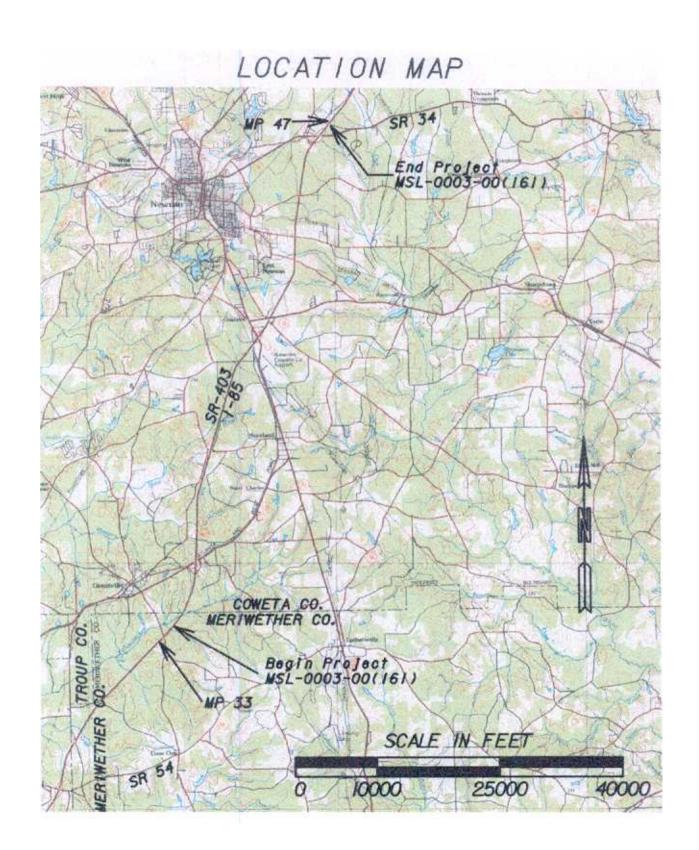
The current probable cost of construction is \$104,473,995 as noted on the MLS-0003(246) – PI# 0003246 Cost Estimate, Troup/Meriwether Counties, contained in the undated Project Concept Report. The project contains inflation at 5.00% per annum for two years (10.25%) and Engineering and Construction of 10.00%.

Therefore, current total cost for both projects is \$224,436,811.

Project Concept Report page \_\_2\_ Project Number: MSL-0003-00(161)

P. I. Number:0003161

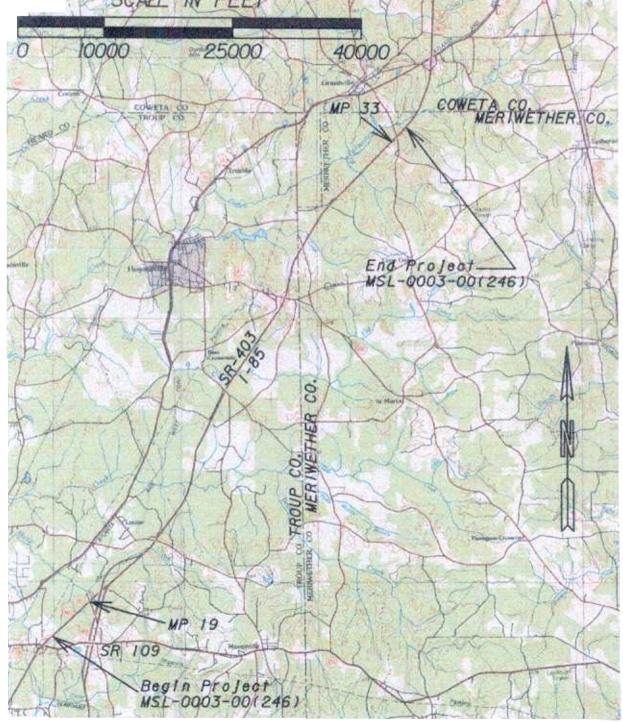
County: Meriwether/Coweta



Project Concept Report page 2 Project Number: MSL-0003-00(246)

P. I. Number: 0003246 County: Troup & Meriwether

# LOCATION MAP



### VALUE ANALYSIS AND CONCLUSIONS

### **GENERAL**

This section describes the value analysis procedure used during the value engineering study. It is followed by separate narratives and conclusions concerning:

- Value Engineering Workshop Agenda
- Value Engineering Workshop Participants
- Economic Data
- Cost Estimate Summary and Cost Histograms
- Function Analysis
- Creative Idea Listing and Judgment of Ideas

A systematic approach was used in the VE study and the key procedures involved were organized into three distinct parts: 1) preparation; 2) VE workshop; and 3) post-study. A Task Flow Diagram that outlines each of the procedures included in the VE study is attached for reference.

### PREPARATION EFFORT

Pre-study preparation for the VE effort consisted of scheduling study participants and tasks; gathering necessary background information on the facility; and compiling project data into a cost model and graphic cost histogram. Information relating to the design, construction, and operation of the facility is important as it forms the basis of comparison for the study effort. Information relating to funding, project planning, operating needs, systems evaluations, basis of cost, soil conditions, and construction of the facility was also a part of the analysis.

### VALUE ENGINEERING WORKSHOP EFFORT

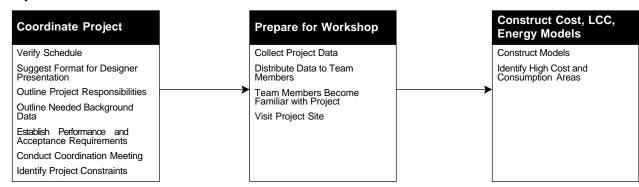
The VE workshop was a three-day effort (see attached agenda). During the workshop, the VE job plan was followed. The job plan guided the search for high cost areas in the project and included procedures for developing alternative solutions for consideration. It includes six phases:

- Information Phase
- Function Identification and Analysis Phase
- Creative Phase
- Evaluation Phase
- Development Phase
- Presentation Phase (*Not conducted*)

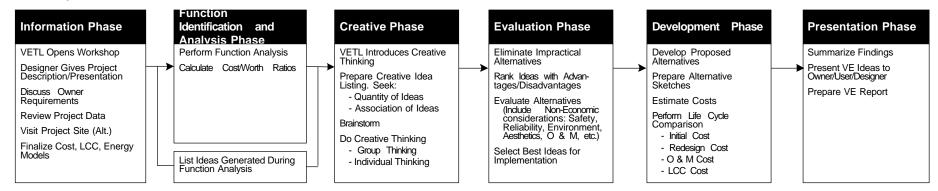


## Value Engineering Study Task Flow Diagram

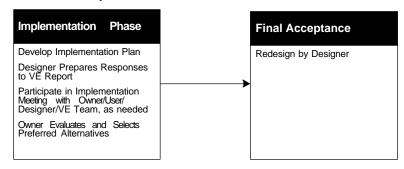
### **Preparation Effort**



### **Workshop Effort**



### Post-Workshop Effort



### **Information Phase**

At the beginning of the study, the conditions and decisions that have influenced the development of the project must be reviewed and understood. For this reason, the development manager presented information about the project to the VE team on the first day of the session. Following the presentation, the VE team discussed the project using the following documents:

- Area Map Indicating Locations for Project No. MSL-0003-00(161), P. I. No. 0003161 and MSL-0003-00(246), P.I. No. 0003246 entitled WIDENING OF SR 403/I-85 FROM SR 109 TO NOURTH OF SR 34; Troup, Meriwether and Coweta Counties; prepared by R. K. Shah & Associates, Inc. for Value Engineering Session, undated;
- *Typical Sections* for Project No. MSL-0003-00(161), P. I. No. 0003161 entitled WIDENING OF SR 403/I-85 FROM NORTH OF FOREST ROAD TO SR 24 INTERCHANGE, Meriwether and Coweta Counties; prepared by R. K. Shah & Associates, Inc. for the Department of Transportation, State of Georgia; dated April 11, 2005;
- *Typical Sections* for Project No. MSL-0003-00(246), P. I. No. 0003246 entitled WIDENING OF SR 403/I-85 FROM SR 109 TO NORTH OF FOREST ROAD, Troup and Meriwether Counties; prepared by J. B. Trimble, Inc. for the Department of Transportation, State of Georgia; dated March 28, 2005;
- Construction Staging Plans for Project No. MSL-0003-00(161), P. I. No. 0003161 entitled WIDENING OF SR 403/I-85 FROM NORTH OF FOREST ROAD TO SR 24 INTERCHANGE, Meriwether and Coweta Counties; prepared by R. K. Shah & Associates, Inc. for the Department of Transportation, State of Georgia; dated April 11, 2005;
- Construction Staging Plans for Project No. MSL-0003-00(246), P. I. No. 0003246 entitled WIDENING OF SR 403/I-85 FROM SR 109 TO NORTH OF FOREST ROAD, Troup and Meriwether Counties; prepared by J. B. Trimble, Inc. for the Department of Transportation, State of Georgia; dated March 29, 2005;
- *Preliminary Bridge Layout I-85 S.B.L. Over SR 14 and CSX Railroad* for Project No. MSL-0003-00(161), P. I. No. 0003161 entitled WIDENING OF SR 403/I-85 FROM NORTH OF FOREST ROAD TO SR 24 INTERCHANGE, Meriwether and Coweta Counties; prepared by Daniel Consultants, Inc. for the Department of Transportation, State of Georgia; dated April 11, 2005;
- *Preliminary Bridge Layout 1-85 N.B.L. Over SR 14 and CSX Railroad* for Project No. MSL-0003-00(161), P. I. No. 0003161 entitled WIDENING OF SR 403/I-85 FROM NORTH OF FOREST ROAD TO SR 24 INTERCHANGE, Meriwether and Coweta Counties; prepared by Daniel Consultants, Inc. for the Department of Transportation, State of Georgia; dated April 11, 2005;
- Preliminary Bridge Layout I-85 Over Bethlehem Road for Project No. MSL-0003-00(161), P. I. No. 0003161 entitled WIDENING OF SR 403/I-85 FROM NORTH OF FOREST ROAD TO SR 24 INTERCHANGE, Meriwether and Coweta Counties; prepared by Daniel Consultants, Inc. for the Department of Transportation, State of Georgia; dated April 11, 2005;
- *Preliminary Bridge Layout I-85 Over CSX Railroad* for Project No. MSL-0003-00(161), P. I. No. 0003161 entitled WIDENING OF SR 403/I-85 FROM NORTH OF FOREST ROAD TO SR 24 INTERCHANGE, Meriwether and Coweta Counties; prepared by Daniel Consultants, Inc. for the Department of Transportation, State of Georgia; dated April 11, 2005;
- Preliminary Bridge Layout I-85 Over SR 14 (US 27 ALT.) for Project No. MSL-0003-00(161), P.
   I. No. 0003161 entitled WIDENING OF SR 403/I-85 FROM NORTH OF FOREST ROAD TO SR

- 24 INTERCHANGE, Meriwether and Coweta Counties; prepared by Daniel Consultants, Inc. for the Department of Transportation, State of Georgia; dated April 11, 2005;
- **Preliminary Bridge Layout SR-16. Over I-85** for Project No. MSL-0003-00(161), P. I. No. 0003161 entitled WIDENING OF SR 403/I-85 FROM NORTH OF FOREST ROAD TO SR 24 INTERCHANGE, Meriwether and Coweta Counties; prepared by Daniel Consultants, Inc. for the Department of Transportation, State of Georgia; dated April 11, 2005;
- Preliminary Bridge Layout Widening I-85 Over Turkey Creek Road for Project No. MSL-0003-00(161), P. I. No. 0003161 entitled WIDENING OF SR 403/I-85 FROM NORTH OF FOREST ROAD TO SR 24 INTERCHANGE, Meriwether and Coweta Counties; prepared by Daniel Consultants, Inc. for the Department of Transportation, State of Georgia; dated April 11, 2005;
- *Preliminary Bridge Layout Widening I-85 Over Southern Railroad* for Project No. MSL-0003-00(161), P. I. No. 0003161 entitled WIDENING OF SR 403/I-85 FROM NORTH OF FOREST ROAD TO SR 24 INTERCHANGE, Meriwether and Coweta Counties; prepared by Daniel Consultants, Inc. for the Department of Transportation, State of Georgia; dated April 11, 2005;
- *Preliminary Bridge Layout CR 103 (Big Poplar Road) Over I-85* for Project No. MSL-0003-00(161), P. I. No. 0003161 entitled WIDENING OF SR 403/I-85 FROM NORTH OF FOREST ROAD TO SR 24 INTERCHANGE, Meriwether and Coweta Counties; prepared by Daniel Consultants, Inc. for the Department of Transportation, State of Georgia; dated April 11, 2005;
- **Preliminary Bridge Layout CR 546 (Lower Fayetteville Road) Over I-85** for Project No. MSL-0003-00(161), P. I. No. 0003161 entitled WIDENING OF SR 403/I-85 FROM NORTH OF FOREST ROAD TO SR 24 INTERCHANGE, Meriwether and Coweta Counties; prepared by Daniel Consultants, Inc. for the Department of Transportation, State of Georgia; dated April 11, 2005;
- Preliminary Bridge Layout Widening I-85 Over SR 34 for Project No. MSL-0003-00(161), P. I.
   No. 0003161 entitled WIDENING OF SR 403/I-85 FROM NORTH OF FOREST ROAD TO SR 24 INTERCHANGE, Meriwether and Coweta Counties; prepared by Daniel Consultants, Inc. for the Department of Transportation, State of Georgia; dated April 11, 2005;
- Typical I-85 Over CSX R.R. Option 1 Recommendation Plan for Project No. MSL-0003-00(161), P. I. No. 0003161 entitled WIDENING OF SR 403/I-85 FROM NORTH OF FOREST ROAD TO SR 24 INTERCHANGE, Meriwether and Coweta Counties; prepared by Sastry and Associates, Inc. for the Department of Transportation, State of Georgia; dated April 11, 2005;
- *I-85 Over Bethlehem Road Option 1 Recommendation Plan* for Project No. MSL-0003-00(161), P. I. No. 0003161 entitled WIDENING OF SR 403/I-85 FROM NORTH OF FOREST ROAD TO SR 24 INTERCHANGE, Meriwether and Coweta Counties; prepared by Sastry and Associates, Inc. for the Department of Transportation, State of Georgia; dated April 11, 2005;
- *I-85 Over SR14 & R.R. Left Bridge S.B.L. Plan* for Project No. MSL-0003-00(161), P. I. No. 0003161 entitled WIDENING OF SR 403/I-85 FROM NORTH OF FOREST ROAD TO SR 24 INTERCHANGE, Meriwether and Coweta Counties; prepared by Sastry and Associates, Inc. for the Department of Transportation, State of Georgia; dated April 11, 2005;
- *I-85 Over SR14 & R.R. Right Bridge S.B.L. Plan* for Project No. MSL-0003-00(161), P. I. No. 0003161 entitled WIDENING OF SR 403/I-85 FROM NORTH OF FOREST ROAD TO SR 24 INTERCHANGE, Meriwether and Coweta Counties; prepared by Sastry and Associates, Inc. for the Department of Transportation, State of Georgia; dated April 11, 2005;

- Typical I-85 NB & SB Bridge Option 1 Recommendation Plan for Project No. MSL-0003-00(161), P. I. No. 0003161 entitled WIDENING OF SR 403/I-85 FROM NORTH OF FOREST ROAD TO SR 24 INTERCHANGE, Meriwether and Coweta Counties; prepared by Sastry and Associates, Inc. for the Department of Transportation, State of Georgia; dated April 11, 2005;
- Concept Plan For Inside Widening of I-85 for Project No. MSL-0003-00(161), P. I. No. 0003161 entitled WIDENING OF SR 403/I-85 FROM NORTH OF FOREST ROAD TO SR 24 INTERCHANGE, Meriwether and Coweta Counties; prepared by R. K. Shah & Associates, Inc. for the Department of Transportation, State of Georgia; dated January 14, 2004, and Value Engineering of April 12, 2005;
- Concept Plan For Inside Widening of I-85 for Project No. MSL-0003-00(246), P. I. No. 0003246 entitled WIDENING OF SR 403/I-85 FROM SR 109 TO NORTH OF FOREST ROAD, Troup and Meriwether prepared by R. K. Shah & Associates, Inc. for the Department of Transportation, State of Georgia; dated January 14, 2004, and Value Engineering of April 12, 2005;
- Existing Bridge Plan for Project No. MSL-0003-00(161), P. I. No. 0003161;
- Existing Bridge Plan for Project No. MSL-0003-00(246), P. I. No. 0003246;
- New Barrier Details, Department of Transportation, State of Georgia;
- Coweta County, Georgia General Highway Map, State of Georgia Department of Transportation dated 1989:
- *Meriwether County, Georgia General Highway Map*, State of Georgia Department of Transportation dated 1984; and
- *Troup County, Georgia General Highway Map*, State of Georgia Department of Transportation dated 1985.

### **Function Identification and Analysis Phase**

Based on historical and background data, a cost model and graphic function analysis were developed for this project by major construction elements. They were used to distribute costs by project element; serve as a basis for alternative functional categorization; and to assign worth to the categories, where worth is the least cost to provide the required function, as determined by the VE team. The VE team identified the functions of the various project elements and subsystems by using random function generation techniques resulting in the attached Random Function Analysis worksheet and/or Function Analysis Systems Technique (F.A.S.T.) diagram.

### **Creative Phase**

This VE study phase involved the creation and listing of ideas. Creative idea worksheets were organized by project element. During this phase, the VE team developed as many ideas as possible to provide the necessary functions within the project at a lower cost to the owner, or to improve the quality of the project. Judgment of the ideas was restricted at this point. The VE team was looking for a large quantity of ideas and free association of ideas.

The Georgia Department of Transportation (GDOT) and the R. K. Shah & Associates, Inc. (RKS) representatives may wish to review the creative list since it may contain ideas that can be further evaluated for potential use in the design.

### **Evaluation Phase**

During this phase of the workshop, the VE team judged the ideas generated during the creative phase. Advantages and disadvantages of each idea were discussed to find the best ideas for development. Ideas found to be irrelevant or not worthy of additional study were discarded. Those that represented the greatest potential for cost savings or improvement to the project were then developed further.

The VE team would like to develop all ideas, but time constraints usually limit the number that can be developed. Therefore, each idea was compared with the present schematic design concepts in terms of how well it met the design intent. Advantages and disadvantages were discussed, and each team member rated the ideas on a scale of zero to five, with the best ideas rated five. Total scores were summed for each idea and only highly-rated ideas were developed into alternatives. In cases where there was little cost impact, but an improvement to the project was anticipated, the designation DS, for design suggestion, was used. The design team should review this listing for possible incorporation of ideas into the project.

The creative listing was re-evaluated frequently during the process of developing alternatives. As the relationship between creative ideas became more clearly defined, their importance and ratings may have changed, or they may have been combined into a single alternative. For these reasons, some of the originally highly-rated items may not have been developed into alternatives.

### **Development Phase**

During the development phase, each highly-rated idea was expanded into a workable solution. The development consisted of a description of the alternative, life cycle cost comparisons, where applicable, and a descriptive evaluation of the advantages and disadvantages of the proposed alternatives. Each alternative was written with a brief narrative to compare the original design to the proposed change. Sketches and design calculations, where appropriate, were also prepared in this part of the study. The VE alternatives are included in the *Study Results* section of the report.

### **Presentation Phase**

The last phase of the VE study usually involves presentation of the findings of the study; however, GDOT now conducts the presentation internally upon receipt of the report. The VE alternatives were screened by the VE team before draft copies of the *Summary of Potential Cost Savings* worksheets were provided to GDOT representatives. The VE alternatives were arranged in the same order as the idea listing sheets to facilitate cross-referencing.

### POST-WORKSHOP EFFORT

The post-study portion of the VE study includes the preparation of this Value Engineering Study Report. Personnel from GDOT will analyze each alternative and prepare a short response, recommending incorporating the alternative into the project, offering modifications before implementation, or presenting reasons for rejection. Lewis & Zimmerman Associates, Inc. is available at your convenience as you review the alternatives. Please do not hesitate to call on us for clarification or further information as you consider an implementation approach.

### **VALUE ENGINEERING STUDY AGENDA**

Lewis & Zimmerman Associates, Inc. (LZA) will conduct a 24-hour VE Study on the MSL-0003-00(161), P.I. No. 0003161 and MSL-0003-00(246), P.I. No. 0003246, projects located in Coweta, Meriwether and Troup Counties, Georgia. It is expected the owner, the Georgia Department of Transportation (GDOT) will be available to make a formal presentation concerning the project at the beginning of the workshop and be available to answer questions during the VE study effort.

### **VE Study Agenda**

The VE study will follow the outline described below and be conducted April 12 - 14, 2005. The study will be conducted in Rooms 274 in GDOT's General Office located at No. 2 Capitol Square Street, Atlanta, Georgia 30334. The point-of-contact is Ms. Lisa L. Myers, Design Review Engineer Manager, who can be reached at 404-651-7468.

### Tuesday, February 12th

8:15 am - 8:30 am General Introduction of all Parties and review of the VE Process

8:30 am - 10:30 am **Owner's / Designer's Presentation** 

GDOT is to present information concerning the project including, but not necessarily limited to: rationale for design; criteria for specific areas of study, project constraints and the reasons for design decisions.

10:30 am - 12:00 noon Commence Function Analysis Phase

The VE team will continue their familiarization with the cost models and project data for each area of study. The cost model(s) will be refined, as necessary; define the function of each project element or system in the cost model, select the primary or basic functions, and determine the worth, or least cost, to provide the function. Cost / worth or value index ratios will be calculated, and high cost / low worth areas for study identified. In addition, the VE team will continue defining the function of each element / system to gain a thorough understanding of the project's needs and requirements.

12:00 noon - 1:00 pm **Lunch** 

1:00 pm - 5:00 pm Conclude the Function Analysis Phase and Commence the Creative Phase

The VE team will conduct a brainstorming session and list as many ideas as possible for consideration. The aim is to obtain a large quantity of ideas through free association, by eliminating roadblocks to creativity and deferring judgment.

### Wednesday, April 13<sup>th</sup>

8:30 am - 10:00 am Conclude Creative Phase and Complete Evaluation / Analytical

**Phase** 

The VE team will analyze the ideas listed in the creative phase and select the best ideas for further development.

10:00 am - 12:00 noon **Development Phase** 

VE team will develop creative ideas into alternate design solutions. Initial and life cycle cost estimates comparing original and proposed alternatives will be prepared. Selected alternatives for change will be developed and supported with sketches, calculations and written substantiation.

12:00 noon - 1:00 pm **Lunch** 

1:00 pm - 5:00 pm **Continue Development Phase** 

Thursday, April 14<sup>th</sup>

8:30 am - 12:00 am **Continue Development Phase** 

12:00 noon - 1:00 pm **Lunch** 

1:00 pm - 4:00 pm Conclude Development Phase and Commence Summary

Worksheets

Upon completion of the Development Phase, the VE facilitator will commence preparation of the summary worksheets based on the alternatives developed by the VE team. The summary work sheets form the basis of the informal oral presentation.

4:00 – 5:00 pm Finalize Summary Worksheets

The VE team will provide draft copies of the *Summary of Potential Cost Savings* worksheets to GDOT representatives and be available to clarify any points.

### VALUE ENGINEERING WORKSHOP PARTICIPANTS

The VE team was organized to provide specific expertise on the unique project elements involved. Team members consisted of a multidisciplinary group with professional design experience and a working knowledge of VE procedures. The VE team included the following professionals:

Gregory C. Grant, PE Director, Structural Engineering, HNTB

Bridge Engineer

Edward F. Culican, Jr., PE Senior Project Manager, HNTB

Transportation/Roadway Engineer

Alex Pascual, PE Structural/Bridge Engineer HNTB

Charles R. McDuff, PE, CVS, CCE Constructibility/Cost Engineer Lewis & Zimmerman Assoc., Inc. Luis M. Venegas, PE, CVS VE Facilitator Lewis & Zimmerman Assoc., Inc.

### OWNER'S/DESIGNER'S PRESENTATION

Representatives from the State of Georgia Department of Transportation and the R. K. Shah & Associates, Inc. design team presented an overview of the project on Tuesday, April 12, 2005. The purpose of this meeting, in addition to being an integral part of the Information Gathering Phase of the VE Study, was to bring the VE team "up-to-speed" regarding the overall project. Additionally, the meeting afforded the design team the opportunity to highlight in greater detail, those areas of the project requiring additional or special attention.

### VALUE ENGINEERING TEAM'S FINAL PRESENTATION

The VE team did not conduct a final, oral presentation on Thursday, April 14, 2005, to GDOT. However, copies of the draft *Summary of Potential Cost Savings* worksheets were provided for interim use by GDOT and the design team.

A copy of the meeting participants is attached for reference.

## **VALUE ENGINEERING ATTENDEES**



### **MEETING PARTICIPANTS**

PROJECT: MSL - 0003-00(161) and (24 INSIDE WIDENING OF SE TROUP COUNTY TO NOE Coweta, Meriwether, and Te Concept Development	Date: <b>April 12 – 14, 2005</b>	
NAME & E-MAIL (PLEASE PRINT)	ORGANIZATION/TITLE	PHONE/FAX
Derrick Cameron	State of Georgia Department of Transportation (GDOT), Office of Traffic and Safety Design	ph: 404-635-8153
em: derrick.cameron@dot.state.ga.us	Traffic Design Supervisor	fx: 404-631-8116
C. Andy Casey, PE	GDOT, Road and Airport Design	ph: 404-657-9757
em: andy.casey@dot.state.ga.us	Transportation Engineer and Project Manager	fx: 404-657-0653
Stanley Hill	GDOT, Road and Airport Design	ph: 404-656-5180
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Lamar Pruitt	GDOT, District 3, Office of Construction	ph: 706-646-6569
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## **VALUE ENGINEERING ATTENDEES**



### MEETING PARTICIPANTS

PROJECT: MSL - 0003-00(161) and (240 INSIDE WIDENING OF SR TROUP COUNTY TO NOR	Date: April 12 – 14, 2005	
Coweta, Meriwether, and Tr Concept Development	coup Counties	
NAME & E-MAIL (PLEASE PRINT)	ORGANIZATION/TITLE	PHONE/FAX
Raju (Rajendrakumar) K. Shah, PE	R. K. Shah & Associates, Inc.	ph: 770-436-5070
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		ph:
em:		fx:
		ph:
em:		fx:
		ph:
em:		fx:

### ECONOMIC DATA

The VE team developed economic criteria used for evaluation with information gathered from the State of Georgia Department of Transportation and R. K. Shah & Associates, Inc. To express costs in a meaningful manner, the VE team alternatives are presented on the basis of discounted present worth. Criteria for planning project period interest rates are based on the following parameters:

Year of Analysis: 2005

Construction Start-Up: 2006

Construction Duration:  $\pm 36 - 48$  Months (2009 – 2010)

Economic Planning Life: 35 years for Pavement Economic Planning Life: 50 years for Bridges

Discount Rate/Interest: 2.25% (Latest United States Office of

Management and Budget Circular A-

94)

Inflation/Escalation Rate: 5.00% (Per RKS)

Uniform Present Worth (UPW) Factor: 21.4872 for 35 years

25.7298 for 50 years

20.25% (1.2025)

Cost of Power: \$0.07/kWHr (kilowatt hour) (assumed)

Operation and Maintenance Costs (*Industry Norms*):

Equipment - With Many Moving Parts 5.00%-5.50%+ of Capital Cost Equipment - With Minimal Moving Parts 3.50%-4.00% of Capital Cost

Equipment - Electronic 3.00% of Capital Cost

Structural 1.00%-2.00% (or less) of Capital Cost

Composite Mark-Up:

(Composed of: Inflation [based on 5.00% per annum for two years] at 10.25%; and Engineering and Construction

at 10.00%.)

### COST ESTIMATE SUMMARY AND COST HISTOGRAMS

The VE team prepared several cost models for the project that are included following this page. The cost models are arranged in the Pareto Charting/Cost Histogram format to aid in identifying high cost areas and are based on the *MSL-0003(161) – PI# 0003161 Cost Estimate*, and *MSL-0003(246) – PI# 0003246 Cost Estimate* prepared by the R. K. Shah & Associates, Inc., the design consultant. As can be expected, judgments at this stage of the study are based on experience and intuition rather than facts, which are not uncovered until well along in the analysis of function. As a result of these qualified hypotheses, there appears to be a potential for initial savings in the following areas:

- Base and Paving
  - Continuous Reinforced Concrete
  - Graded Aggregate Base Course
  - Asphalted Concrete
  - Guardrail
- Major Structures
  - Bridge Widening and Deck Replacement
  - Bridge Jacking
- Lumps Sum Items
  - Detour Pavement
  - Erosion Control
- Miscellaneous
  - Concrete Barrier, Type S-1
  - Game and Right-of-Way Fencing
- Grading and Drainage

### **DESIGNER'S COST ESTIMATE**

The cost estimate, as described above, did contain sufficiently detailed information to perform a VE evaluation.



Project: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP **COUNTY TO NORTH OF SR 34 IN COWETA COUNTY** Coweta, Meriwether, and Troup Counties

Concept Developme	nt						
TOTAL	PROJECT				COST	PERCENT	CUM. PERCENT
Base and Paving					132,225,304		70.87%
Major Structures - Ten Bridges					25,192,440		84.37%
Lump Sum Items					15,669,810		92.77%
Miscellaneous Items					8,816,063		97.49%
Grading and Drainage					4,555,100		99.93%
Special Items				_	124,000		100.00%
		Construction			186,582,717	100.00%	
Inflation - Based on 5			10.25%	\$	19,124,728		
En	gineering and Const	Construct	10.00%	\$ <b>\$</b>	18,658,272 <b>224,365,717</b>		
			-Of-Way	φ	N/A		
		Kigiii	Utilities		TBD		
		GRAND		\$	224,365,717	Comp Mark-Up:	20.25%
		GRAIND	TOTAL	Ψ	224,303,717	Comp Wark-Op.	20.2370
\$0	\$26,450,000	\$52,90	0,000		\$79,350,000	\$105,800,000	\$132,250,000
Base and Paving							
				_			
-							
Major Structures - Ten Bridges							
	_						
Lump Sum Items							
Miscellaneous Items							
_							
Grading and Drainage							
Special Items							
Costs in graph are not marked-	up.				 		



Project: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

MISL-0003-00(161) COST PERCENT PERCENT	Concept Developm										CL IN#	
Major Structures - Ten Bridges   19,874,000   19,93%   84.44%	MSL-0	003-00(1	61)				со	ST	PERC	ENT	CUM. PERCEN	Т
1.545,660   1.5.7%   92.0%	Base and Paving											
Miscellaneous Items    S.407,336   S.42%   97.43%     Canding and Drainage   2,501,100   2.51%     Special Items   Construction Subtotal												
Special Items												
Construction Subtoal   8 - 99,701,056   100,00%												
Construction Subtotal   S 99,701,056   100,00%							2,					
Inflation - Based on 5.00% per annum for 2 years @ 10.25% \$ 10,219.388	Special Items										100.	00%
Engineering and Construction   10,00%   \$ 9,970,106									1(	00.00%		
Construction Total   \$ 119,890,520   Right-Of-Way   Miscellaneous Hems   Construction Total   \$ 119,890,520   Comp Mark-Up:   20.25%												
Right-Of-Way   N/A   Utilities   TBD   T	I	engineering an										
Utilities   TBD			•			\$						
Sq.   \$12,880,000   \$25,760,000   \$38,640,000   \$51,520,000   \$64,400,000				Right								
Base and Paving  Major Structures - Ten Bridges  Lump Sum Items  Grading and Drainage  Special Items				CDAND		ф			C 1	4 1 TT	20.250/	
Base and Paving  Major Structures - Ten Bridges  Lump Sum Items  Grading and Drainage  Special Items				JKAND	IOIAL	Þ	119,8	590,520	Comp N	ark-Up:	20.25%	
Major Structures - Ten Bridges  Lump Sum Items  Miscellaneous Items  Grading and Drainage  Special Items	\$0	\$12,88	0,000	\$25,76	60,000		\$38,64	0,000	\$51,52	20,000	\$64,400,0	000
Major Structures - Ten Bridges  Lump Sum Items  Miscellaneous Items  Grading and Drainage  Special Items	]											
Major Structures - Ten Bridges  Lump Sum Items  Miscellaneous Items  Grading and Drainage  Special Items												
Major Structures - Ten Bridges  Lump Sum Items  Miscellaneous Items  Grading and Drainage  Special Items	Base and Paving											
Lump Sum Items  Miscellaneous Items  Grading and Drainage  Special Items	Dase and Laving											
Lump Sum Items  Miscellaneous Items  Grading and Drainage  Special Items												
Lump Sum Items  Miscellaneous Items  Grading and Drainage  Special Items	1											
Lump Sum Items  Miscellaneous Items  Grading and Drainage  Special Items												
Lump Sum Items  Miscellaneous Items  Grading and Drainage  Special Items												
Miscellaneous Items  Grading and Drainage  Special Items	Major Structures - Ten Bridges											
Miscellaneous Items  Grading and Drainage  Special Items												
Miscellaneous Items  Grading and Drainage  Special Items												
Miscellaneous Items  Grading and Drainage  Special Items	-											
Miscellaneous Items  Grading and Drainage  Special Items												
Miscellaneous Items  Grading and Drainage  Special Items												
Grading and Drainage  Special Items	Lump Sum Items											
Grading and Drainage  Special Items												
Grading and Drainage  Special Items												
Grading and Drainage  Special Items	†											
Grading and Drainage  Special Items		_										
Grading and Drainage  Special Items	V. 11											
Special Items	Miscellaneous Items											
Special Items												
Special Items												
Special Items	1											
Special Items												
Special Items	Grading and Drainage											
	Gracing and Dramage											
	Special Items											
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Costs in graph are not marked-up												
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	Costs in graph are not marked	l-un										



Project: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

Continuously Reinforced Concrete - 11" New   18,928,553   29,43%	Concept Developme	nt					
18,228,553   29,43%   58,87%   58,87%   58,77%   58,99,020   57,96%   67,	MSL-0003-00(161)	- Base and Pavi	ng		COST	PERCENT	CUM. PERCENT
12,280,109   19,09%   77,99%   77,99%   77,99%   5,699,020   8,86%   86,82%   8,85%					18,928,553	29.43%	29.43%
September   Sept					18,928,553	29.43%	
Asphaltic Concrete 19mm, 330 lb/sy - 3" New   4,475,569   6,96%   93.78%		- 11" Shoulders			12,280,109	19.09%	77.96%
Asphaltic Concrete Overlay							
1,234,632   1,92%   99,92%					4,475,569		
Signaturinous Tack Coat							
Construction Subtotal   Society		ng					
Inflation - Based on 5.00% per annum for 2 years@ 10.25% \$ 6.591,873	Bituminous Tack Coat						100.00%
Engineering and Construction @ 10,00%   \$ 6, 431,096     Construction Total   \$ 77,333,929     Right-Of-Way   N/A     Utilities   TBD     GRAND TOTAL   \$ 77,333,929   Comp Mark-Up:   20,25%     SQ			on Subtotal			100.00%	
Construction Total   \$ 77,333,929   Right-Or-Way   N/A   Utilities   TBD     GRAND TOTAL   \$ 77,333,929   Comp Mark-Up:   20.25%							
Right-Of-Way Utilities The Composition of the Compo	Engi						
Continuously Reinforced Concrete -  11" New  Continuously Reinforced Concrete -  11" Shoulders  Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Asphaltic Concrete Overlay -  Leveling  Bituminous Tack Coat				\$			
SQ \$3.800,000 \$7.600,000 \$11.400,000 \$15.200,000 \$19,000,000  Continuously Reinforced Concrete- 11" Overlay  Continuously Reinforced Concrete- 11" Shoulders  Graded Aggregate Base 12"  Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat		Rig					
SQ \$3.800,000 \$7.600,000 \$11,400,000 \$15,200,000 \$19,000,000  Continuously Reinforced Concrete - 11" New  Continuously Reinforced Concrete - 11" Shoulders  Graded Aggregate Base 12"  Asphaltic Concrete 19mm, 330 lb/sy - 3" New  Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Bituminous Tack Coat							
Continuously Reinforced Concrete - 11" Overlay  Continuously Reinforced Concrete - 11" Shoulders  Graded Aggregate Base 12"  Asphaltic Concrete 19mm, 330 lb/sy - 3" New  Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Bituminous Tack Coat		GRAN	D TOTAL	\$	77,333,929	Comp Mark-Up:	20.25%
Continuously Reinforced Concrete - 11" Overlay  Continuously Reinforced Concrete - 11" Shoulders  Graded Aggregate Base 12"  Asphaltic Concrete 19mm, 330 lb/sy - 3" New  Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat	\$0	\$3,800,000	\$7,600,000		\$11,400,000	\$15,200,000	\$19,000,000
Continuously Reinforced Concrete - 11" Overlay  Continuously Reinforced Concrete - 11" Shoulders  Graded Aggregate Base 12"  Asphaltic Concrete 19mm, 330 lb/sy - 3" New  Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat							
Continuously Reinforced Concrete- 11" Overlay  Continuously Reinforced Concrete- 11" Shoulders  Graded Aggregate Base 12"  Asphaltic Concrete 19mm, 330 lb/sy - 3" New  Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat	,						
Continuously Reinforced Concrete - 11" Shoulders  Graded Aggregate Base 12"  Asphaltic Concrete 19mm, 330 lb/sy - 3" New  Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Bituminous Tack Coat	11" New						
Continuously Reinforced Concrete - 11" Shoulders  Graded Aggregate Base 12"  Asphaltic Concrete 19mm, 330 lb/sy - 3" New  Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Bituminous Tack Coat							
Continuously Reinforced Concrete - 11" Shoulders  Graded Aggregate Base 12"  Asphaltic Concrete 19mm, 330 lb/sy - 3" New  Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Bituminous Tack Coat	1						
Continuously Reinforced Concrete - 11" Shoulders  Graded Aggregate Base 12"  Asphaltic Concrete 19mm, 330 lb/sy - 3" New  Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Bituminous Tack Coat	Continuously Reinforced Concrete -						
Graded Aggregate Base 12"  Asphaltic Concrete 19mm, 330 lb/sy - 3" New  Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat	1						
Graded Aggregate Base 12"  Asphaltic Concrete 19mm, 330 lb/sy - 3" New  Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat							
Graded Aggregate Base 12"  Asphaltic Concrete 19mm, 330 lb/sy - 3" New  Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat	-						
Graded Aggregate Base 12"  Asphaltic Concrete 19mm, 330 lb/sy - 3" New  Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat				-			
Asphaltic Concrete 19mm, 330 lb/sy - 3" New  Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat	,						
Asphaltic Concrete 19mm, 330 lb/sy - 3" New  Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat	11" Shoulders						
Asphaltic Concrete 19mm, 330 lb/sy - 3" New  Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat							
Asphaltic Concrete 19mm, 330 lb/sy - 3" New  Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat							
Asphaltic Concrete 19mm, 330 lb/sy - 3" New  Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat							
Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat	Graded Aggregate Base 12"						
Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat							
Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat	-						
Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat							
Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay  Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat							
Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat	- 3 New						
Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat							
Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat							
Asphaltic Concrete Overlay - Leveling  Bituminous Tack Coat	Asphaltic Concrete 19mm, 330 lb/sy						
Leveling  Bituminous Tack Coat							
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Bituminous Tack Coat	-						
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Project: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246
INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP
COUNTY TO NORTH OF SR 34 IN COWETA COUNTY
Coweta, Meriwether, and Troup Counties
Concept Development

Concept Development						OLINA.
MSL-0003-00(161) -	<b>Major Structu</b>	res		COST	PERCENT	CUM. PERCENT
Br 1 LT SBL I-85 over SR 14 / CSX F	RR			1,931,000	9.72%	9.72%
Br 10 RT NBL I-85 over SR 34				1,873,000	9.42%	19.14%
Br 1 RT NBL I-85 over SR 14 / CSX I	RR			1,870,000	9.41%	28.55%
Br 10 LT SBL I-85 over SR 34				1,835,000	9.23%	37.78%
Br 4 LT SBL I-85 over SR 14 / US 27				1,731,000	8.71%	46.49%
Br 4 RT NBL I-85 over SR 14 / US 27	7			1,731,000	8.71%	55.20%
Br 3 LT SBL I-85 over CSX RR				1,268,000	6.38%	61.58%
Br 3 RT NBL I-85 over CSX RR				1,218,000	6.13%	67.71%
Br 7 LT SBL I-85 over Southern RR				977,000	4.92%	72.63%
Br 7 RT NBL I-85 over Southern RR	1.0.1			977,000	4.92%	77.54%
Br 2 LT SBL I-85 over Bethlehem Chi				929,000	4.67%	82.22%
Br 2 RT NBL I-85 over Bethlehem Ch				929,000	4.67%	86.89%
Br 6 LT SBL I-85 over Turkey Creek				920,000	4.63%	91.52%
Br 6 RT NBL I-85 over Turkey Creek Br 5 SR 16 over I-85 - Jacking	Koau			920,000 277,000	4.63% 1.39%	96.15% 97.54%
Br 9 Lower Fayette Rd over I-85 - Jack	king			254,000	1.28%	98.82%
Br 8 Big Poplar Road over I-85 - Jacki				234,000	1.18%	100.00%
Bi 8 Big ropiai Road over 1-83 - Jack	-	ion Subtotal	\$	19,874,000	100.00%	100.00%
Inflation - Based on 5.00%			\$	2,037,085	100.00 /0	
	ering and Construction @		\$	1,987,400		
Eligino		ruction Total		23,898,485		
		ght-Of-Way	Ψ	N/A		
	Tu,	Utilities		TBD		
	GRAN	ND TOTAL	\$	23,898,485	Comp Mark-Up:	20.25%
				- / /	1	
\$Q	\$390,000	\$780,000		\$1,170,000	\$1,560,000	\$1,950,000
Br 1 LT SBL I-85 over SR 14 / CSX	,			,		
RR						
Br 10 RT NBL I-85 over SR 34						<u>_</u>
Br 1 RT NBL I-85 over SR 14 / CSX						
RR						
Br 10 LT SBL I-85 over SR 34						
Br 4 LT SBL I-85 over SR 14 / US 27						
D 4 DELVIN 4 05						
Br 4 RT NBL I-85 over SR 14 / US 27						
D 01 001 102 001 001						
Br 3 LT SBL I-85 over CSX RR						
D 0000000 100						
Br 3 RT NBL I-85 over CSX RR						
1				1		
Br 7 LT SBL I-85 over Southern RR				•		
1				1		
Br 7 RT NBL I-85 over Southern RR				•		
Br 2 LT SBL I-85 over Bethlehem						
Br 2 RT NBL I-85 over Bethlehem Church Road						
Br 6 LT SBL I-85 over Turkey Creek						
Road			-			
Br 6 RT NBL I-85 over Turkey Creek Road						
Br 5 SR 16 over I-85 - Jacking						
Br 9 Lower Fayette Rd over I-85 - Jacking						
Br 8 Big Poplar Road over I-85 - Jacking						
Costs in graph are not marked-up.	·	•		·	•	·



Project: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP

COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

Concept Development MSL-0003-00(161)	- Lump Sum Ite	ms	COST	PERCENT	CUM. PERCENT
Detour Pavement - 191,399 sy			4,782,500	63.38%	63.38%
Erosion Control			1,825,710	24.20%	87.58%
Clearing and Grubbing - 996 Acres			475,200	6.30%	93.87%
Traffic Control			400,000	5.30%	99.18%
Grassing - 87 Acres			62,250	0.82%	100.00%
		tion Subtotal	7,545,660	100.00%	
Inflation - Based on 5.0	0% per annum for 2 years@	0 10.25%	\$ 773,430		
Engi	neering and Construction @		\$ 754,566		
		ruction Total	9,073,656		
	R	ight-Of-Way	N/A		
		Utilities	TBD		
	GRA	ND TOTAL	\$ 9,073,656	Comp Mark-Up:	20.25%
\$0	\$960,000	\$1,920,000	\$2,880,000	\$3,840,000	\$4,800,000
]	İ			İ	
Detour Pavement - 191,399 sy					
1					
Erosion Control					
Erosion Control					
Clearing and Grubbing - 996 Acres					
Clearing and Grubbling - 990 Acres					
-					
Traffic Control					
Traine Condor					
†					
Grassing - 87 Acres					
	I	I	1	I	l
Costs in graph are not marked-up	•				



Project: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties Concept Development

Concept Developm	nent	-			0,
MSL-0003-00(161)	- Miscellaneous Item	ıs	COST	PERCENT	CUM. PERCENT
Concrete Barrier, TP S-1			2,178,600	40.29%	40.29%
Fence, Right-of-Way, Game			1,785,600	33.02%	73.31%
Approach Slabs			522,100	9.66%	82.97%
Guardrail, Type W			273,710	5.06%	88.03%
Precast Barrier, Method 3			258,120	4.77%	92.80%
CCTV - Remote Control Camera			180,000	3.33%	96.13%
Precast Barrier, Method 4			101,160	1.87%	98.00%
Guardrail Anchorage, Type 12			71,346	1.32%	99.32%
Guardrail Anchorage, Type 1			20,700	0.38%	99.70%
Aggregate Surface Course			16,000	0.30%	100.00%
	Construction S	ubtotal	\$ 5,407,336	100.00%	
Inflation - Based on 5	.00% per annum for 2 years@ 10	).25%	\$ 554,252	•	
En	gineering and Construction @ 10	0.00%	\$ 540,734		
	Construction	n Total	\$ 6,502,322		
	Right-C		N/A		
		Jtilities	TBD		
	GRAND T		\$ 6,502,322	Comp Mark-Up:	20.25%
\$Q	\$436 <u>,</u> 000 \$872	2,000	\$1,308,000	\$1,744,000	\$2,180,000
1			i		
Concrete Barrier, TP S-1					
Concrete Barrier, 17 S-1					
_					
Fence, Right-of-Way, Game					
-					
Approach Slabs					
]					
Guardrail, Type W					
Guardian, Type W					
_					
Precast Barrier, Method 3					
-					
CCTV - Remote Control Camera					
<u> </u>					
Precast Barrier, Method 4					
riccust Barrier, Method 4	•				
_					
Guardrail Anchorage, Type 12					
Guardrail Anchorage, Type 1					
Aggregate Surface Course					
1.55.55ac Sarace Course					
Costs in graph are not marked	un				
Costs in graph are not marked-	·up.				



Project: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP

**COUNTY TO NORTH OF SR 34 IN COWETA COUNTY** 

Coweta, Meriwether, and Troup Counties

	61) - Grading a	and Drainage		COST	PERCENT	CUM. PERCENT
rainage				1,856,100	74.21%	74.21%
nclassified Excavation				645,000	25.79%	100.00%
Inflation D	1 5 000/	Construction Subtotal		2,501,100	100.00%	
Inflation - Ba	ased on 5.00% per annum Engineering and C		\$	256,363 250,110		
	Lingineering and C	Construction Total		3,007,573		
		Right-Of-Way		N/A		
		Utilities		TBD		
		GRAND TOTAL	\$	3,007,573	Comp Mark-Up:	20.25%
\$0	\$375,000	\$750,000	\$1	,125,000	\$1,500,000	\$1,875,000
Drainage						
Unclassified Excavation						



Project: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

B FOT A	002 00/2	40					от.	p=p -		CUM	
	003-00(2	46)				СО	ST	PERC	ENT	PERCEN	
Base and Paving							,914,344		78.17%		8.17%
Lump Sum Items							,124,150		9.35%		7.52%
Major Structures - Ten Bridges							,318,440		6.12%		3.64%
Miscellaneous Items							,408,727		3.92%		7.56%
Grading and Drainage						2,	,054,000		2.36%		9.93%
Special Items							62,000		0.07%	100	0.00%
			onstruction				881,661	10	00.00%		
Inflation - Based or			•	10.25%	\$		905,370				
	Engineering and	d Constru		10.00%	\$		588,166				
			Construct		\$		475,197				
			Kignt	-Of-Way		N/					
			CDAND	Utilities	ф	TB		C 1	4 1 TT	20.250	2/
			GRAND	IOIAL	Þ	104,4	<b>475,197</b>	Comp IV	Iark-Up:	20.259	%
\$0	\$13,60	0,000	\$27,20	00,000		\$40,80	0,000	\$54,40	00,000	\$68,000	0,000
]											
Base and Paving											
-											
Lump Sum Items											
1											
Major Structures - Ten Bridges											
Major Structures - Tell Bridges											
Miscellaneous Items											
-											
Grading and Drainage											
1											
Special Items											
Special Items											
J	ı			1					II.	i,	



Project: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Develop MSL-0003-00(2		nd Pavii	ng		COST	PERCENT	CUM. PERCENT
Continuously Reinforced Conc	crete - 11" New				20,671,200	30.44%	30.44%
Continuously Reinforced Conc					20,671,200	30.44%	60.87%
Continuously Reinforced Conc	crete - 11" Shoulde	rs			11,662,200	17.17%	78.05%
Graded Aggregate Base 12"					5,906,452	8.70%	86.74%
Asphaltic Concrete 19mm, 330					4,635,400	6.83%	93.57%
Asphaltic Concrete 19mm, 330		1			2,964,420	4.36%	97.93%
Asphaltic Concrete Overlay - L	Leveling				1,349,040	1.99%	99.92%
Bituminous Tack Coat					54,432	0.08%	100.00%
		Constructio		\$	67,914,344	100.00%	
Inflation - Based o	on 5.00% per annum	-	10.25%	\$	6,961,220		
	Engineering and Co		10.00%	\$	6,791,434		
			ction Total	\$	81,666,999		
		Rigl	nt-Of-Way		N/A		
		CDANI	Utilities	ф	TBD	Como Mode Her	20.25%
		GRANI	O TOTAL	\$	81,666,999	Comp Mark-Up:	20.25%
	\$0\$4,13	5,000	\$8,270,000		\$12,405,000	\$16,540,000	\$20,675,000
Continuously Reinforced Concrete -							
11" New							
	-						
Continuously Reinforced Concrete -							
11" Overlay							
Continuously Reinforced Concrete -							
11" Shoulders	_						
Graded Aggregate Base 12"							
Asphaltic Concrete 19mm, 330 lb/sy - 3" New							
Asphaltic Concrete 19mm, 330 lb/sy - 3" Overlay	,						
Asphaltic Concrete Overlay - Leveling							
Bituminous Tack Coat							
Costs in graph are not mark	ed-up.		•		· 	· 	

Project: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP

**COUNTY TO NORTH OF SR 34 IN COWETA COUNTY** 

Coweta, Meriwether, and Troup Counties

Concept Development

Concept Development MSL-0003-00(246)	- Lump Sum Ite	ms		COST	PERCENT	CUM. PERCENT
Detour Pavement - 208900 sy				5,222,500	64.28%	64.28%
Erosion Control				1,900,000	23.39%	87.67%
Clearing and Grubbing - 407 Acres				488,400	6.01%	93.68%
Traffic Control				400,000	4.92%	98.61%
Grassing - 151 Acres				113,250	1.39%	100.00%
		tion Subtotal		8,124,150	100.00%	
	0% per annum for 2 years@		\$	832,725		
Engi	neering and Construction @		\$	812,415		
		ruction Total	\$	9,769,290		
	K	ight-Of-Way		N/A		
	CDA	Utilities	ø	TBD	Com Mode II.	20.250/
	GKA	ND TOTAL	\$	9,769,290	Comp Mark-Up:	20.25%
\$0	\$1,045,000	\$2,090,000		\$3,135,000	\$4,180,000	\$5,225,000
]						
Detour Pavement - 208900 sy						
-						
Erosion Control						
Prosion Control						
1						
	_					
_						
Clearing and Grubbing - 407 Acres						
	1					
_						
Traffic Control						
	J					
Grassing - 151 Acres						
J						
Costs in graph are not marked-up.						

Project: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concent Development

Concept Developme	nt .					
MSL-0003-00(246)	- Major Structu	res	(	COST	PERCENT	CUM. PERCENT
Br 1 LT SBL I-85 over Beach Cree	k			1,016,400	19.11%	19.11%
Br 1 RT NBL I-85 over Beach Cree	ek			1,016,400	19.11%	38.22%
Br 2 LT SBL I-85 over Flat Creek				914,760	17.20%	55.42%
Br 2 RT NBL I-85 over Flat Creek				914,760	17.20%	72.62%
Br 8 SR 54 over I-85				232,560	4.37%	76.99%
Br 5 Simms Road (CR 17) over I-8:	5			208,245	3.92%	80.91%
Br 7 Hines Bridge Road over I-85				177,090	3.33%	84.24%
Br 3 Forest Road over I-85				172,440	3.24%	87.48%
Br 6 S-2097 (Hogansville Rd.) over	· I-85			172,440	3.24%	90.72%
Br 4 Sewell Road over I-85				165,115	3.10%	93.83%
Br 10 I-185 NB over I-85 - Jacking				164,115	3.09%	96.91%
Br 9 I-185 SB over I-85 - Jacking				164,115	3.09%	100.00%
		on Subtotal		5,318,440	100.00%	
	0% per annum for 2 years@	10.25%	\$	545,140		
Eng	ineering and Construction @	10.00%	\$	531,844		
		iction Total		6,395,424		
	Rig	ht-Of-Way		N/A		
	a= ·	Utilities		TBD		20.25
	GRAN	D TOTAL	\$	6,395,424	Comp Mark-Up:	20.25%
\$0	\$204,000	\$408,000		\$612,000	\$816,000	\$1,020,000
1			_			
Br 1 LT SBL I-85 over Beach Creek						
D- 1 DT NDL 1 95 D						
Br 1 RT NBL I-85 over Beach Creek						
						1
Br 2 LT SBL I-85 over Flat Creek						J
						1
Br 2 RT NBL I-85 over Flat Creek						•
-						
D 0 0D 54 105						
Br 8 SR 54 over I-85						
-						
D- 5 Ci D1 (CD 17) I 95						
Br 5 Simms Road (CR 17) over I-85						
Br 7 Hines Bridge Road over I-85						
Di / Times Bridge Road over 1-03						
1_						
Br 3 Forest Road over I-85						
Br 3 r diest Road over 1 03						
-						
Br 6 S-2097 (Hogansville Rd.) over						
I-85						
1						
Br 4 Sewell Road over I-85						
1						
Br 10 I-185 NB over I-85 - Jacking						
1						
Br 9 I-185 SB over I-85 - Jacking						
Contain manh and a track	•	,			•	·
Costs in graph are not marked-u	ν.					

Project: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246 INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties Concept Development

Concept Developm	nent					0.114
MSL-0003-00(246)	- Miscellaneous It	tems		COST	PERCENT	CUM. PERCENT
Fence, Right-of-Way, Game				1,944,320	57.04%	57.04%
Approach Slabs				433,570	12.72%	69.76%
Concrete Barrier, TP S-1				284,400	8.34%	78.10%
Precast Barrier, Method 3				284,400	8.34%	86.45%
Guardrail, Type W				221,190	6.49%	92.93%
CCTV - Remote Control Camera				120,000	3.52%	96.45%
Guardrail Anchorage, Type 12				72,897	2.14%	98.59%
Guardrail Anchorage, Type 1				21,150	0.62%	99.21%
Aggregate Surface Course				16,000	0.47%	99.68%
Precast Barrier, Method 4				10,800	0.32%	100.00%
	Construction	on Subtotal	\$	3,408,727	100.00%	
Inflation - Based on 5	5.00% per annum for 2 years@	10.25%	\$	349,395	<del>,</del>	
Er	ngineering and Construction @	10.00%	\$	340,873		
		iction Total	\$	4,098,994		
		ht-Of-Way		N/A		
		Utilities		TBD		
	GRAN	D TOTAL	\$	4,098,994	Comp Mark-Up:	20.25%
	Ozdai (	~	-	, <del>-</del>	1F.	
\$0	\$390,000	\$780,000		\$1,170,000	\$1,560,000	\$1,950,000
]						
Fence, Right-of-Way, Game						
-						
Approach Slabs						
1						
Concrete Barrier, TP S-1						
Concrete Barrier, 1P S-1						
Precast Barrier, Method 3						
-						
Guardrail, Type W						
	_					
COTTY D C I.C						
CCTV - Remote Control Camera	_					
Guardrail Anchorage, Type 12						
In						
Guardrail Anchorage, Type 1						
1_						
Aggregate Surface Course						
Precast Barrier, Method 4						
Costs in graph are not marked	-IID					
Costs in graph are not marked	up.					



Project: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP

**COUNTY TO NORTH OF SR 34 IN COWETA COUNTY** 

Coweta, Meriwether, and Troup Counties

	Development								
MSL-0003-0	00(246) - Gra	ding and Drai	inage		COST	PERC	ENT	CUM PERCEN	
Drainage					1,346,000		65.53%		5.53%
Unclassified Excavation	on				708,000		34.47%	100	0.00%
			ion Subtotal		2,054,000	10	00.00%		
Inflatio	on - Based on 5.00% pe			\$	210,535				
	Engineeri	ng and Construction @		\$	205,400				
			uction Total		2,469,935				
		KIŞ	ght-Of-Way Utilities		N/A TBD				
		GRAN	D TOTAL		2,469,935	Comp N	1ark-Up:	20.259	<u>/</u> 6
		OILLI.	101112	Ψ	2,102,200	comp in	тите орг	20.237	
\$	0 \$270	,000 \$540	,000	\$8	310,000	\$1,080	,000	\$1,350	0,000
Drainage									
Unclassified Excavation									
Costs in graph are r	ot marked-up.								

### **FUNCTION ANALYSIS**

A function analysis was performed to: (1) define the requirements for each project element; and (2) ensure a complete and thorough understanding by the VE team of the basic function(s) needed to attain a given requirement. A *Random Function Analysis* worksheet for the project is attached. This part of the function analysis stimulated the VE team members to think in terms of the areas in which to channel their creative idea development.

Function Analysis is a means of evaluating a project to see if the expenditures actually perform the requirements of the project, or if there are disproportionate amounts of money spent on support functions. These elements add cost to the final product, but have a relatively low worth to the basic function.

The Random Function Analysis effort identified the project's basic functions as: INCREASE/CAPACITY and IMPROVING/LEVEL OF SERVICE by Reducing/Congestion and Travel Time and Preventing/Pavement Failure.

## RANDOM FUNCTION ANALYSIS



PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

SHEET NO.: 1 of 1

DESCRIPTION		FUNCTION		
2.201	VERB	NOUN	KINI	
	Improve	Level of Service	В	
	Reduce	Congestion	В	
	Reduce	Travel Time	В	
	Improve	Safety	RS	
	Increase	Capacity	В	
	Prevent	Pavement Failure	В	
	Increase	Vertical Clearance	S	
	Upgrade	Structures	S	
	Upgrade	Geometry	RS	
	Improve	Pavement Cross Drainage	RS	
	Satisfy	Users	НО	
	Continue	Widening of Corridor	G	
	Facilitate	Future Expansion	G	
	Maintain	Two Lanes of Traffic During Construction	RS	
	Expands	Intelligent Transportation System (ITS) Corridor	S	
	Maintain	Current Right-of-Way	N/A	
	Control	Access	N/A	
	Minimize	Animal Induced Accidents	S	

RS =

Required Secondary

Objective

0 =

### CREATIVE IDEA LISTING AND JUDGMENT OF IDEAS

During the creative phase, numerous ideas, alternative proposals, and/or recommendations were generated using conventional brainstorming techniques as recorded on the following pages.

These ideas were then discussed and the advantages/disadvantages of each listed. The VE design team compared each of the ideas with the concept solution determining whether it improved value, was equal in value, or lessened the value of the solution.

The ideas were then ranked on a scale of one to five on how well the VE design team believed the idea met necessary criteria and program needs. The higher rated ideas were then developed into formal alternatives and included in the VE workshop. Some ideas were judged to have minimal cost impacts on the project but provided enhancements in the form of improved operations, efficiency, constructibility, or potential to save unknown or hidden costs. These were given the designation "DS" which indicates a design suggestion. This designation is also used when an idea is difficult to price but improves the functionality of the project or system, and is deemed to be of significant value to the owner, user, operator, or designer.

Typically, all ideas rated four or above are included in the Study Report. When this is not the case, an idea was combined with another related idea or discarded, as a result of additional research that indicated the concept was not cost-effective or technically feasible.

The reader is encouraged to review the *Creative Idea Listing and Evaluation* worksheets since they may suggest additional ideas that can be applied to the design.

## CREATIVE IDEA LISTING



PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

Coweta, Meriwether, and Troup Counties

Concept Development

SHEET NO.: 1 of 2

NO.	IDEA DESCIRPTION	RATING
1	Expand to the middle	5
2	Fully replace pavement with concrete	2
3	Localized pavement replacement at bridges and interchanges	4
4	Use 4.75 millimeter (mm) flexible mix for interlayer of pavement cross section	4
5	Use 9.50 mm flexible mix for interlayer of pavement cross section	4
6	Meet the 16.5-ft. vertical clearance	4
7	Move ultimate section into median use the existing full-depth pavement section	5
8	Maintain a 16.0-ft. minimum vertical clearance	5
9	Replace all mainline bridges	3
10	Widen to the outside	2
11	Eliminate new fencing	4
12	Do not touch the Poplar Road bridge due to a new interchange at this location	4
13	Build the Poplar Road bridge to meet future interchange criteria	4
14	Make the Poplar Road interchange part of this project	4
15	Use pre-welded mats in lieu of hand-tied reinforcing bars	DS
16	Use 60 kips per square inch (ksi) steel in lieu of 40ksi steel	DS
17	Maintain existing super elevation	1
18	Increase pavement edge reinforcement to reduce pavement width 2.0 ft.	3
19	Eliminate future lane	2
20	Use higher strength steel with higher strength concrete to reduce the thickness of the continuous-reinforced-concrete (CRC)	DS
21	Increase CRC thickness and increase reinforcing bar spacing to minimize the use of steel	DS
22	Decrease CRC thickness by increasing concrete strength	DS
23	Decrease CRC thickness by increasing steel strength	DS
24	Use a thickened edge on outside lane in lieu of 2.0 ft. additional full depth pavement	4
25	Use asphalt in lieu of CRC for full-depth pavement replacement	2
Function	3	Goal Jnwanted

## CREATIVE IDEA LISTING



PROJECT: MSL - 0003-00(161) and (246), PI Nos. 0003161 and 0003246

INSIDE WIDENING OF SR 403/I-85 FROM NORTH OF SR 109 IN TROUP COUNTY TO NORTH OF SR 34 IN COWETA COUNTY

**Coweta, Meriwether, and Troup Counties** 

Concept Development

SHEET NO.: 2 of 2

NO.	IDEA DESCIRPTION	RATINO
26	Eliminate the Intelligent Transportation System's (ITS) closed circuit televisions (CCTVs	1
27	Flatten curves at substandard super elevated curves	2
28	Develop southbound auxiliary exit lane at SR 109 near STA 200+00 to avoid an expensiv scissors bridge	e
unction	defined as: Action Verb Kind: B = Basic HO = Higher Order G = Measurable Noun S = Secondary LO = Lower Order U = RS = Required Secondary O = Objective	Goal Unwanted